SESSION TIMETABLE

20179119 / 2017-32-0119	SETC2017 Best Paper
20179xxx / 2017-32-0xxx	SETC2017 High Quality Papers (9 papers)
20179xxx / 2017-32-0xxx	SAE Journal Papers

SETC2017 Session Timetable (20 minutes-presentation and 10 minutes-discussion / each paper)

November 15th Wednesday	8:30-10:00		**Opening Ceremony & Keynote Speech**				
	10:00-10:30		Networking Break & Poster Session				
	Room		A (Merak 1)	B (Merak 2)	C (Merak 3)	D (Nuri 1)	E (Kakatua)
	10:30-12:00		Collegiate Events	HCCI I	Functional Safety	Vehicle Dynamics & Safety I	Diesel Engine I
		Chair	Akira Iijima	Tatsuya Kuboyama	Takashi Mitome	Masayuki Baba	Tomoaki Yatsufusa
		Co-Chair	Mike Marcella	Adrian Irimescu	Tony Sczcotka	Thomas Lagö	Iman K. Reksowardojo
						20179018/2017-32-0018	20179046 / 2017-32-0046
			20179087 / 2017-32-0087	20179073 / 2017-32-0073	20179057/2017-32-0057	20179033/2017-32-0033	20179101 / 2017-32-0101
			20179110 / 2017-32-0110	20179106 / 2017-32-0106	20179083/2017-32-0083	20179053/2017-32-0053	20179089 / 2017-32-0089
	12:00-13:30		Lunch & Poster Session				
	13:30-15:00		Hybrids, Electric Drive, Fuel Cells	HCCI II	Materials	Vehicle Dynamics & Safety II	Diesel Engine II
		Chair	Yasuyuki Muramatsu	Hibiki Koga	Aki Kodai	Hisayuki Sugita	Tadao Okazaki
		Co-Chair	Roland Kirchberger	Adrian Irimescu	Ken Fosaaen	Sangriyadi Setio	Iman K. Reksowardojo
			20179039 / 2017-32-9039	20179061 / 2017-32-0061	20179006 / 2017-32-0006	20179086/2017-32-0086	20179030 / 2017-32-0030
			20179104 / 2017-32-9104	20179090 / 2017-32-0090	20179056 / 2017-32-0056	20179099/2017-32-0099	20179035 / 2017-32-0035
			20179079 / 2017-32-9079	20179096 / 2017-32-0096	20179125 / 2017-32-0125		20179032 / 2017-32-0032
	15:00-15:30		Networking Break & Poster Session				
	15:30-17:30		Fuel Supply Systems	HCCI III	NVH Technology	Measurement & Simulation I	Diesel Engine III
		Chair	Michihisa Nakagawa	Tomoo Shiozaki	Hiroshi Yano	Tadao Okazaki	Keiya Nishida
		Co-Chair	Tony Sczcotka	Adrian Irimescu	Thomas Lagö	Stephan Schmidt	Iman K. Reksowardojo
			20179002 / 2017-32-0002	20179084 / 2017-32-0084	20179034 / 2017-32-0034	20179020 / 2017-32-0020	20179105 / 2017-32-0105
			20179017 / 2017-32-0017	20179085 / 2017-32-0085	20179068 / 2017-32-0068	20179130 / 2017-32-0130	20179107 / 2017-32-0107
			20179059 / 2017-32-0059		20179066 / 2017-32-0066	20179036 / 2017-32-0036	20179115 / 2017-32-9115
			20179131 / 2017-32-0131		20179075 / 2017-32-0075	20179067 / 2017-32-0067	

November 16th Thursday	9:00-11:30		Plenary Session				
	11:30-13:00		Lunch & Poster Session				
	13:00-14:30		Advanced Combustion I	Alternative Fuels I	Emissions&Environmental Impact I	Measurement & Simulation II	Two Stroke Engine I
		Chair	Akihito Kasai	Tohru Nakazono	Hiromi Deguchi	Michihisa Nakagawa	Tomoo Shiozaki
		Co-Chair	Simona Merola	Iman K. Reksowardojo	Kai Beck	Stephan Schmidt	Pierre Duret
			20179050 / 2017-32-0050	20179070 / 2017-32-0070	20179009 / 2017-32-0009	20179027 / 2017-32-0027	20179037 /2017-32-0037
			20179112 / 2017-32-0112	20179078 / 2017-32-0078	20179011 / 2017-32-0011	20179028 / 2017-32-0028	20179043 / 2017-32-0043
			20179118 / 2017-32-0118	20179092 / 2017-32-0092	20179116 / 2017-32-0116	20179097 / 2017-32-0097	
	14:30-15:00		Networking Break & Poster Session				
	15:00-16:30		Advanced Combustion II	Alternative Fuels II	Emissions&Environmental Impact II	Measurement & Simulation III	Two Stroke Engine II
		Chair	Akihito Kasai	Hiroya Ueda	Hiromi Deguchi	Michihisa Nakagawa	Tomoo Shiozaki
		Co-Chair	Simona Merola	Ken Fosaaen	Kai Beck	Adrian Irimescu	Roland Kirchberger
			20179119 / 2017-32-0119	20179054 / 2017-32-0054	20179041 / 2017-32-0041	20179047 / 2017-32-0047	20179121 / 2017-32-0121
			20179091 / 2017-32-0091		20179042 / 2017-32-0042	20179048 / 2017-32-0048	20179082 / 2017-32-0082
			20179120 / 2017-32-0120			20179113 / 2017-32-0113	
November 17th Friday	8:00-9:30		Advanced Combustion III	Alternative Fuels III	Emissions&Environmental Impact III	Measurement & Simulation IV	Engine Component I
		Chair	Koji Yoshida	Tohru Nakazono	Hiromi Deguchi	Tadao Okazaki	Takahito Murase
		Co-Chair	Simona Merola	Iman K. Reksowardojo	Kai Beck	Adrian Irimescu	Tony Sczcotka
			20179069 / 2017-32-0069	20179103/ 2017-32-0103	20179076 / 2017-32-0076	20179071 / 2017-32-0071	20179055 / 2017-32-0055
			20179111 / 2017-32-0111	20179088 / 2017-32-0088	20179094 / 2017-32-0094	20179074 / 2017-32-0074	20179124 / 2017-32-0124
					20179126 / 2017-32-0126	20179038 / 2017-32-0038	
	9:30-10:00		Networking Break & Poster Session				
	10:00-11:30		Advanced Combustion IV	Lubricants	Vehicle Components	Engine Controls	Engine Component II
		Chair	Koji Yoshida	Tohru Nakazono	Hisayuki Sugita	Yutaka Nitta	Yuji Araki
		Co-Chair	Simona Merola	Mike Marcella	Ignatius P. Nurprasetio	Ken Fosaaen	Roland Kirchberger
			20179064 / 2017-32-0064	Organized Speech (Pertamina Lubricants)	20179049 / 2017-32-0049	20179045 / 2017-32-0045	20179003 / 2017-32-0003
			20179077 / 2017-32-0077	20179008 / 2017-32-0008	20179123 / 2017-32-0123	20179052 / 2017-32-0052	20179060 / 2017-32-0060
				20179095 / 2017-32-0095		20179065 / 2017-32-0065	
	11:30-13:30		Lunch, Award & Closing Ceremony				

TECHNICAL SESSION

1. Date	November 15 th Wednesday
2. Room.	A (Merak 1)
3. Time	11:00 – 12:00
4. Session	Collegiate Events
5. Chair (Affiliation), Co-chair (Affiliation)	Akira Iijima (Nihon University), Mike Marcella (Maxima Racing Oils)

6. Paper No.(JSAE/SAE)	20179087 / 2017-32-0087
7. Paper title	Clean and Sustainable Energy for Small Urban Car
8. Author (Affiliation)	Sangriyadi Setio, Wiranto Arismunandar, Rudy Ong, Adefrid Dwithama, Stefanus Adrian, Angela Claudia, Nu'man Amri Maliky, Jery Octavianus, Muhammad Alif Mabbrur, Michell Tjhoi (Institut Teknologi Bandung)

9. Abstract

Developing and designing fuel efficient vehicle for a one gallon of fuel marathon is a challenging task. Engines have to be optimized to achieve maximum fuel efficiency. In this study, we evaluate the optimal compression ratio (CR) and ignition timing that produce the best torque in a custom gasoline-based-motorcycle-engine that use ethanol E100 fuel. In the first experiment, CR was adjusted between 9 and 12 to evaluate its effect on the engine mileage's record. The experiment was conducted on the test track. In the second experiment, Ignition timing was adjusted by a custom-made engine control unit (ECU) between 15 deg. and 45 deg. before top dead center (BTDC). The engine performance was investigated in terms of best torque and brake specific fuel consumption (BSFC), with variation of engine speed between 1500 and 8000. The test was conducted on dynamometer. The test was also performed in constant compression ratio and stoichiometric air-fuel ratio, 9. The best result is used to develop the clean, sustainable, and efficient small urban car for Shell Eco-marathon Asia competition. We achieved the best CR of 12 with the average mileage of 212.3 km/liter. The lowest BSFC is obtained at 4500 rpm, which generates 9.68 Nm.

6. Paper No.(JSAE/SAE)	20179110 / 2017-32-0110
7. Paper title	An Investigation on the Design and Manufacturing of Powertrain System for Student Formula Japan (SFJ) Vehicle
8. Author (Affiliation)	Daisuke Kagawa (Graduate School of Kokushikan University), Tomoaki Kodama, Yasuhiro Honda (Kokushikan University)

9. Abstract

The main purpose of Student Formula Japan competition (hereafter called "SFJ") is to let students learn the basic ability necessary for engineers through design, fabrication and test projects. In this study the authors decided to adopt Honda BC-PC37E which was an engine for motor cycles. Then the engine have strength enough for the light weight, downsizing design. As the course of the competition consists of short straights and many corners for running within equal to or less than middle speed range, the engine must have excellent acceleration performance to reduce the lap times in the corners. The effective engine performance is necessary for the flat torque in all of engine speed range, especially in low engine speed range. As the regulation allows that a turbocharger is fitted to an engine, its introduction is effective for getting high torque in the low engine speed range. In this study the authors investigate the influences of the main specifications and the characteristics of important power train components, such as turbocharger, throttle, air restrictor, air collector, intake manifold (intake system), exhaust manifold (exhaust system), camshaft, valve timing and dual system of injection, on the improvement of the engine performance by analytical methods, experiments and driving tests. The conclusions are as follows: (1) The brake torque of the engine by adopting the turbocharger in the lower range of A/R (Area of inlet port/Radius of turbine, hereafter called "A/R") has become higher in the low engine speed range. (2) In the case that the length of intake pipe is extended, the brake torque has been increased in the low engine speed range and decreased greatly in the high engine speed range.

1. Date	November 15th　Wednesday
2. Room.	A (Merak 1)
3. Time	13:30-15:00
4. Session	Hybrids, Electric Drive, Fuel Cells
5. Chair (Affiliation), Co-chair (Affiliation)	Yasuyuki Muramatsu　(Yamaha Motor Co.,Ltd) Roland Kirchberger (Graz University of Technology)

6. Paper No.(JSAE/SAE)	20179039 / 2017-32-9039
7. Paper title	Development of New Compact Hybrid System
8. Author (Affiliation)	Satoshi Itoh, Michiyasu Yamamoto (Suzuki Motor Corporation.)

9. Abstract

One of the fuel efficiency improvement policy of Small vehicle included Regenerative Braking System (JSAE 20139006 / SAE 2013-32-9006), but developed New Compact Hybrid System to realize further fuel efficiency improvement. Losses for the engine friction occurred without separating an engine by the former system when deceleration energy was collected, but realized the recovery of the effective kinetic-energy by separating an engine by this system, and regenerating. The new system collect deceleration energy in decelerating time and coasting as well as Regenerative Braking System, but the fuel consumption with the engine is minimized by running EV in the collected energy and realize further fuel efficiency improvement. In addition, the assist is performed in collected energy, and fuel efficiency improvement and compatibility of accelerating performance are planned.

6. Paper No.(JSAE/SAE)	20179104 / 2017-32-9104
7. Paper title	Development of a Dynamic Lifetime Prediction Model for Ultracapacitors based on Accelerated Aging Tests
8. Author (Affiliation)	C.J. Chiang, T.F. Kuo, Weiliem Abubakar, G. Lee, W.R. Huang (National Taiwan University of Science and Technology)

9. Abstract

The purpose of this thesis is to establish a dynamic an Ultracapacitor model, including equivalent circuit model, a thermal dynamic model and an aging model. Model parameter identification is conducted based on Alternative Current Impedance Spectroscopy (ACIS) experiment and least squares method to obtain the Ultracapacitor equivalent series resistance (ESR), constant phase element magnitude (Adl), electrolyte resistance (Rel) and constant phase element exponent (γ) at various voltages and temperatures. Various mathematical models are applied to describe the aging process of parameters. The Ultracapacitor aging model is then validated against voltage and temperature measurements under various charge/discharge cycles at nature heat dissipation condition. All the experiment results indicated that the Ultracapacitor aging model is capable of predictions the dynamic behaviors of Ultracapacitor after various periods of aging process. Keywords: Ultracapacitor, Aging Model, Alternative Current Impedance Spectroscopy.

6. Paper No.(JSAE/SAE)	20179079 / 2017-32-9079
7. Paper title	Study on Appropriate Cooling System According to the Output of the Motor and Inverter for Small EV
8. Author (Affiliation)	Tsukasa Shimizu, Jin Ito, Hideki Shirazawa, Yasuyuki Muramatsu (Yamaha Motor Co.,Ltd)

9. Abstract

It is important to make small and light weight motor for small EV. It is necessary to select appropriate cooling system (liquid cool or air cool) according to motor output. We thought that there is a threshold output that makes the volume smaller and the weight lighter including the liquid cooling system.
As a result of the rough calculation, it was found that the weight can be reduced by adopting the liquid cooling for at about 10kW or more.
In this study we focused on motor and cooling system volume and weight and tried to clarify appropriate cooling system according to motor output.

1. Date	November 15th Wednesday
2. Room.	A (Merak 1)
3. Time	15:30 – 17:30
4. Session	Fuel Supply Systems
5. Chair (Affiliation), Co-chair (Affiliation)	Michihisa Nakagawa (Kawasaki Heavy Industries, Ltd.) Tony Sczcotka (Robert Bosch LLC)

6. Paper No.(JSAE/SAE)	20179002 / 2017-32-0002
7. Paper title	Application of a New-concept Gasoline Pump Injector (GPI) on a Motorcycle Engine
8. Author (Affiliation)	Balasubramanian N.(Stanadyne India Private Limited, Indian Institute of Technology Madras), Keerthi G. R.(Indian Institute of Technology Madras), Nithin J. T.(Indian Institute of Technology Madras), Jayabalan S. (Stanadyne India Private Limited), Anand T. N. C.(Indian Institute of Technology Madras)

9. Abstract

This paper presents the results of tests using a prototype pump-integrated port fuel injector that is designed for small gasoline engines. The unique construction of the injector eliminates the need for a separate feed pump. The device is intended as a solution to meet the upcoming emission norms similar to Euro 6 standards, to be implemented in Asian countries. In particular, the Indian two-wheeler market which produces around 20 million vehicles annually [1], migrates to Bharat Stage VI (BS VI) emission standards in the year 2020. This market is largely cost-driven and currently most of the motorcycles use carburettors as fuelling systems. It is expected that the adoption of port fuel injection would be inevitable to meet the BS VI emission norms…

6. Paper No.(JSAE/SAE)	20179017 / 2017-32-0017
7. Paper title	Spray Characteristics Optimization for Small Motorcycle Engine Using Internal Cylinder Flow Analysis
8. Author (Affiliation)	Yuzuru Sasaki, Nobuhiko Yamaguchi, Akira Arioka(Keihin Corporation), Katsunori Komuro, Dai Kataoka, Shunji Akamatsu(Honda R&D Co., Ltd.)

9. Abstract

In recent times, due to the improvement of internal cylinder flow analysis technology with Computational Fluid Dynamics (CFD), the prediction accuracy of fuel consumption and emission has improved. However, small motorcycles often have complex intake ports which restrict the layout of injectors. Therefore optimization of injection spray to achieve high combustion efficiency and less wall wetting is a challenge. In this study, we predicted fuel consumption and emission performance by the simulation result of air fuel distribution and wall wetting amount with an actual motorcycle engine model. We optimized injector nozzle length, spray angle and spray tip penetration. After the optimization, we evaluated the emission performance and fuel consumption with an actual engine. As a result, we were able to confirm the improvement of fuel consumption and emission performance.

6. Paper No.(JSAE/SAE)	20179059 / 2017-32-0059
7. Paper title	Effects of Port Injection Specifications on Emission Behavior of THC and Engine Maximum Power
8. Author (Affiliation)	Yoshinori Nakao, Atsushi Hisano, Masahito Saitou, Kozo Suzuki, Katsumi Sobakiri(Kawasaki Heavy Industries, Ltd.)

9. Abstract

In this paper, it is also elucidated that the influence of the downstream injection, which caused different fuel behavior in contrast with upstream injection, on the THC after warmup and at the maximum power, as well as its mechanism. The mechanism is clarified by use of the intake port visualization system. First, at each injection position, the effect of injection timing on THC emission after warm-up was evaluated. In the downstream injection, THC emission increases during the injection timing, in which the fuel spray directly flows in-cylinder during the intake process (hereinafter defined as the intake valve opening injection timing), and the amount of THC emission is reduced at the other injection timing (hereinafter defined as the intake valve closing injection timing)…

6. Paper No.(JSAE/SAE)	20179131 / 2017-32-0131
7. Paper title	The Way of Suppressing Self-excited Vibration in Small Pressure Regulator for Small Motorcycles
8. Author (Affiliation)	Takashi Yokoo, Takeshi Enomoto, Masaki Morita(Aisan Industry Co., Ltd.)

9. Abstract

In recent years, the adoption of electronically-controlled fuel injection system (commonly called “FI”) of motorcycles is accelerating for the purpose of fuel efficiency improvement to meet tighter emission controls around the world and to protect global environment. The main stream of the motorcycle market is small motorcycles with an engine size of 100cc to 150cc, therefore downsizing and lowering the cost of FI products are being demanded. Pressure regulator (hereafter called P/R) installed in fuel pump module (hereafter called FPM), one of FI products for motorcycles, is being shifted to ball valve type from diaphragm type due to the downsizing demands. However, the ball valve type has problems such as abnormal noise and pressure adjusting defect that are caused by self-excited vibration…

1. Date	November 15th Wednesday
2. Room.	B (Merak 2)
3. Time	11 : 00-12 : 00
4. Session	HCCI　I
5. Chair (Affiliation), Co-chair (Affiliation)	Tatsuya Kuboyama (Chiba University), Adrian Irimescu (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179073 / 2017-32-0073
7. Paper title	Numerical Investigations of the Auto-Ignition Ranges of a Natural Gas Fueled HCCI Engine
8. Author (Affiliation)	Jörn Judith, Denis Neher, Maurice Kettner (Karlsruhe University of Applied Sciences), Markus Klaissle (SenerTec Kraft-Wärme-Energiesysteme GmbH), Darko Kozarac (University of Zagreb)

9. Abstract

Homogeneous charge compression ignition (HCCI) in natural gas fueled engines is thought to achieve high efficiency and low NOx emissions. While automotive applications require various load and speed regions, the operation range of stationary cogeneration engines is narrower. Hence, HCCI operation is easier to reach and more applicable to comply with future emission standards.
This study presents computationally investigations of the auto-ignition ranges of a stationary natural gas HCCI engine. Starting from a detailed 1D engine cycle simulation model, a reduced engine model was developed and coupled to chemical kinetics using AVL Boost. Compression ratio, airfuel ratio, internal EGR rate (iEGR) and intake temperature were varied for three different speeds, namely 1200, 1700 and 2200 rpm. Each examination includes a full factorial design study of 375 configurations.
In the first step, the combustion was calculated using the GRI-mechanism 3.0 and a single zone combustion model. The data generated was analyzed and single effects of the design parameters on auto-ignition characteristics were derived. In the second step, quadratic regression models were built and sensitivity analysis was performed. Compression ratio and intake temperature show the largest impact on auto-ignition timing (AIT) and auto-ignition temperature, whereas iEGR and air-fuel ratio mainly influence indicated mean effective pressure (IMEP). The design space indicates narrower autoignition range at lower engine speed due to decreasing volumetric efficiency and increasing heat losses.

6. Paper No.(JSAE/SAE)	20179106 / 2017-32-0106
7. Paper title	Dynamic Modeling of a Homogeneous Charge Compression Ignition Engine with Exhaust Throttle
8. Author (Affiliation)	C. J., Chiang, J. W. Wu, T. F. Kuo, Kenny Purnomo (National Taiwan University of Science and Technology)

9. Abstract

Homogeneous charge compression ignition (HCCI) engines create a more efficient power source for either stationary power generators or automotive applications. Control of HCCI engines, however, is difficult since the ignition cannot be actuated directly. For the purpose of model-based analysis and control design, a crank-angle based HCCI engine model is developed in this paper based on experimental data from a single-cylinder engine. The zero-dimensional dynamic engine model is constructed based on conservation of mass and energy, and ideal gas law. Subsystems in this model included valve lift profile, cylinder volume, mass flow rate, intake and exhaust runner dynamics, cylinder dynamics, combustion model and heat-transfer model. Inputs to the model include engine speed, intake temperature, fueling rate, intake throttle and exhaust throttle positions. Outputs of the model include indicate mean effective pressure (IMEP), combustion timings, air-to-fuel ratio (AFR), and the pressure, temperature, mass and burned gas fraction in the cylinder, intake and exhaust runners. Identification and validation of the combustion model were first conducted based on the steady-state cylinder pressure measurement and the combustion analysis results. With the inclusion of intake and exhaust runner dynamics and cylinder filling dynamics, the complete HCCI engine model is then validated against steady-state experimental data at various intake temperatures and transient experimental data during step changes of fueling rate exhaust throttle position. Simulation results also contain details such as mass flow rate through the intake and exhaust valves and cylinder charge conditions during the transient. In the future, this model can be used for control design and hardware in the loop (HIL) simulation and testing.

1. Date	November 15 th Wednesday
2. Room.	B (Merak 2)
3. Time	13:30 – 15:00
4. Session	HCCI II
5. Chair (Affiliation), Co-chair (Affiliation)	Hibiki Koga(Honda R&D Co., Ltd.), Adrian Irimescu (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179061 / 2017-32-0061
7. Paper title	The Effect of In-Cylinder Flow and Mixture Distributions on Combustion Characteristics in a HCCI Engine
8. Author (Affiliation)	Shogo Watanabe, Tatsuya Kuboyama, Yasuo Moriyoshi (Chiba University), Kei Yoshimura (SUZUKI MOTOR CORPORATION)

9. Abstract

It has been widely known that thermal and fuel stratifications of in-cylinder mixture are effective to reduce in-cylinder pressure rise rate during high load HCCI operations. In order to optimize a combustion chamber design and combustion control strategy for HCCI engines with wide operational range, it is important to know quantitatively the influence of the mixture distributions of temperature and fuel concentration on ignition and heat release characteristics. At the same time, it is important to know the influence of in-cylinder flow and turbulence on the temperature and mixture concentration distributions. In this study, a numerical simulation of HCCI combustion were conducted to investigate the effects of the in-cylinder flow and turbulence, and the distributions of temperature on ignition and combustion characteristics in HCCI combustion. As a result, the initial temperature distribution of the cylinder air-fuel mixture was found to be effective for slowing the combustion because the large distribution of the scale is not easily influenced by the mixing due to the flow. In addition, it was found that the combustion slows down when the temperature gradient is wide in the combustion region.

6. Paper No.(JSAE/SAE)	20179090 / 2017-32-0090
7. Paper title	Influence of Engine Speed on Autoignition and Combustion Characteristics in a Supercharged HCCI Engine
8. Author (Affiliation)	Hiroto Tanaka, Tatsuya Sato, Shuntaro Takano, Yuya Motoki, Hyota Hoshino, Yuya Higuchi, Akira Iijima, Hideo Shoji (Nihon University)

9. Abstract

Homogeneous Charge Compression Ignition (HCCI) combustion has attracted widespread interest because it achieves high efficiency and can reduce particulate matter (PM) and nitrogen oxide (NOx) emissions simultaneously. However, because HCCI engines lack a physical means of initiating ignition, it is difficult to control the ignition timing. Another issue of HCCI engines is that the combustion process causes the cylinder pressure to rise rapidly. The time scale is also important in HCCI combustion because ignition depends on the chemical reactions of the mixture. Therefore, we investigated the influence of the engine speed on autoignition and combustion characteristics in an HCCI engine. A four-stroke single-cylinder engine equipped with a mechanically driven supercharger was used in this study to examine HCCI combustion characteristics under different engine speeds and boost pressures. The results revealed that the engine speed range can be expanded by a mechanically driven supercharger. It was also found that there was no change in the ignition delay time under conditions of a constant equivalence ratio even at different engine speeds. The findings of this study provide important knowledge for controlling the ignition timing.

6. Paper No.(JSAE/SAE)	20179096 / 2017-32-0096
7. Paper title	Effect of Fuel Injection Parameters on Performance and Emission Characteristics in HCCI Engine - A CFD Study
8. Author (Affiliation)	H. R. Guru Kiran, J. M. Mallikarjuna (Indian Institute of Technology Madras)

9. Abstract

Today, homogenous charge compression ignition (HCCI) engines are becoming very popular because of their potential to reduce soot and nitric oxides (NOx) emissions simultaneously. But, their performance and emission characteristics are very much dependent upon fuel injection strategy and parameters. However, they also have many challenges viz., improper combustion phasing, high rate of pressure rise and narrow operating range. Therefore, addressing them is very essential before making them a commercial success.
This study focuses on evaluating the effect of fuel injection strategy and parameters on the performance and emission characteristics of a HCCI engine by computational fluid dynamics (CFD) analysis. In this study, a four-stroke engine operating in the HCCI mode is considered and the CFD analysis is carried out by using the CONVERGE. All the CFD simulations are carried out from the inlet valve opening (IVO) to the exhaust valve opening (EVO) period, at the engine speed of 1500 rev/min., with the compression ratio of 16:1. Here, homogeneous mixture is achieved by the injection of fuel into the engine cylinder directly during the early compression stroke, with the fuel injection pressure of 800 bar. The analysis is carried out to study the effect of multiple fuel injection strategy, fuel mass split ratio, injection timing and pressure on the performance and emission characteristics of the engine. In addition, the results of the HCCI mode are compared with that of the conventional CI engine operating at the same load conditions…

1. Date	November 15th Wednesday
2. Room.	B (Merak 2)
3. Time	15:30 – 17:00
4. Session	HCCI III
5. Chair (Affiliation), Co-chair (Affiliation)	Tomoo Shiozaki (Honda R&D Co., Ltd.) Adrian Irimescu (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179084 / 2017-32-0084
7. Paper title	A Study of Combustion in an HCCI Engine Using Non-equilibrium Plasma Discharge Assist
8. Author (Affiliation)	Hyota Hoshino, Tatsuya Sato, Shuntaro Takano, Yuya Motoki, Hiroto Tanaka, Yuya Higuchi, Akira Iijima, Tomohiko Asai, Mitsuaki Tanabe, Hideo Shoji (Nihon University)

9. Abstract

This study focused on a non-equilibrium plasma discharge as a means of assisting HCCI combustion. Experiments were conducted with a four-stroke single-cylinder engine fitted with a spark electrode in the top of the combustion chamber for continuously generating non-equilibrium plasma from the intake stroke to the exhaust stroke.

The results showed that applying non-equilibrium plasma to the HCCI test engine advanced the main combustion period that otherwise tended to be delayed as the engine speed was increased. In addition, it was found that the combined use of exhaust gas recirculation and non-equilibrium plasma prevented a transition to partial combustion while suppressing cylinder pressure oscillations at high loads.

6. Paper No.(JSAE/SAE)	20179085 / 2017-32-0085
7. Paper title	Analysis of Supercharged HCCI Combustion Using Low-carbon Alternative Fuels
8. Author (Affiliation)	Masaaki TOGAWA, Takeshi NISHIYAMA, Keito AGUI, Yuki TAKAMURA, Akira IIJIMA, Hideo SHOJI (Nihon University)

9. Abstract

This study investigated the effects of recirculated exhaust gas (EGR) and its principal components of N2, CO2 and H2O on moderating Homogeneous Charge Compression Ignition (HCCI) combustion. Experiments were conducted using two types of gaseous fuel blends of DME/propane and DME/methane as the test fuels. The addition rates of EGR, N2, CO2 and H2O were varied and the effects of each condition on HCCI combustion of propane and methane were investigated. The results revealed that the addition of CO2 and H2O had the effect of substantially delaying and moderating rapid combustion. The addition of N2 showed only a slight delaying and moderating effect. The addition of EGR had the effect of optimally delaying the time of combustion, while either maintaining or increasing the indicated mean effective pressure and indicated thermal efficiency ηi.

1. Date	November 15th Wednesday
2. Room.	C (Merak 3)
3. Time	11:00-12:00
4. Session	Functional Safety
5. Chair (Affiliation), Co-chair (Affiliation)	Takashi Mitome (SUZUKI MOTOR CORPORATION) Tony Sczcotka (Robert Bosch LLC)

6. Paper No.(JSAE/SAE)	20179057 /2017-32-0057
7. Paper title	ISO 26262 C Class Evaluation Method for Motorcycles by Expert Riders Incorporating Technical Knowledge Obtained from Actual Riding Tests
8. Author (Affiliation)	Maki Kawakoshi, Takashi Kobayashi, Makoto Hasegawa (Japan Automobile Research Institute)

9. Abstract

In applying the ISO 26262 controllability classification for motorcycles in actual riding tests, a subjective evaluation by expert riders is considered to be the appropriate approach from the viewpoint of safety. We studied the construction of an expert-rider-based C class evaluation method for motorcycles and developed some evaluation test cases reproducing various hazardous events. We determined that it was necessary to accumulate more evaluation cases for further representative scenarios and that, to avoid variations in such evaluations, a method in which different expert riders can carry out testing following a common understanding had to be devised.

Considering these problems for practical application, this study aimed at establishing an actual riding test method for C class evaluation by expert riders and to develop a deeper understanding of test procedures and management. To this purpose, representative hazards related to electrical/electronic (E/E) system failures particular to motorcycle control characteristics were extracted by referring to the hazard cases of passenger cars and ISO/DIS 26262. C class evaluation tests were conducted on some extracted hazards to obtain comparable class ratings. On the basis of the riders' comments and discussion, it was confirmed that interpreting a baseline for the C0 rating in each assumed scenario is useful in developing a common rider understanding during subjective evaluations. We organized the resulting technical knowledge set and added it to the existing classification method, creating a C class expert-rider-based evaluation method for motorcycles that can feasibly be used in practice.

6. Paper No.(JSAE/SAE)	20179083 /2017-32-0083
7. Paper title	Detailed Study of Hazard Analysis and Risk Assessment of ISO 26262 for Motorcycles
8. Author (Affiliation)	Makoto Hasegawa, Takanobu Kaneko (Japan Automobile Research Institute)

9. Abstract

ISO 26262, an international functional safety standard of electrical and/or electronic systems (E/E systems) for motor vehicles, was published in November 2011 and it is expected that the scope will be extended to motorcycles in a second edition of ISO 26262 going to be published in 2018. ISO/DIS 26262 second edition published in 2016 has Part 12 as a new part in order to apply ISO 26262 to motorcycle. Proper estimation of Exposure, Controllability, and Severity in accordance with ISO/DIS 26262 Part 12, are key factors to determine Motorcycle Safety Integrity Level. To estimate precise these factors, there would be a case that it might not be appropriate to apply studies done for passenger car to motorcycle, and it would be necessary to apply motorcycle specific knowledge and estimation methods. In our previous studies we clarified these motorcycle specific issues and studied the method for the adaptation. In this study we executed Hazard Analysis and Risk Assessment and estimated Exposure, Controllability and Severity based on the knowledge and methodology we have accumulated. The motivation of our work are to show precise Exposure, Controllability and Severity estimation with concrete rationales, and contribute to motorcycle industry's functional safety application.

1. Date	November 15th Wednesday
2. Room.	C (Merak 3)
3. Time	13:30 - 15:00
4. Session	Materials
5. Chair (Affiliation), co-chair (Affiliation)	Aki Kodai (Kawasaki Heavy Industries, Ltd.) Ken Fosaaen (Kerdea Technologies)

6. Paper No.(JSAE/SAE)	JSAE 20179006 / SAE 2017-32-0006
7. Paper title	The Effect of Tempering Condtions on the Delayed Fracture Characteristics of Carbuized Steels
8. Author (Affiliation)	Yoichi Inoue, Toshiya Ohta, Hirotaka Kurita (Yamaha Motor Co., Ltd.)

9. Abstract

A carburizing is widely applied for many kinds of engine components for motorcycles. On the other hand, a delayed fracture phenomenon of strengthened steel materials occurred under actual usage is a serious concern. The delayed fracture characteristics of surface modified steels such as carburized steels followed by a tempering have a difficulty being evaluated by only measuring a partial characteristic of the hardened portion due to the existence of an inhomogeneity of a microstructure and a gradient of strength. Therefore, the studies on the characteristics of the delayed fracture of the surface modified steels are not so many.
In this paper, the authors evaluated the delayed fracture characteristics of carburized and tempered actual components by comparing hydrogen desorption curves acquired with a thermal desorption spectroscopy using hydrogen-charged specimens with changing tempering conditions. The results from this survey indicate that the delayed fracture characteristics have a relationship with the microstructural transformation of the tempered martensite depending on the tempering conditions for the carburized steels.

6.Paper No.(JSAE/SAE)	JSAE 20179056 / SAE 2017-32-0056
7. Paper title	Development of Low Cost Alminium Tapered Handlebar for Motorcycles
8. Author (Affiliation)	Hirotoshi Inui, Toru Sakurai, Eiichi Sato (Honda R&D Co., Ltd.), Tadashi Minoda, Yasuhiro Nakai (UACJ Extrusion Nagoya Corporation)

9. Abstract

Tapered handlebars using high strength aluminum alloys have been applied mainly to motorcycle models requiring weight reduction and high texture appearance that aluminum handlebars can offer as their characteristics. This handle bar is manufactured through extrusion processing. Conventionally used alloys had low extrusion productivity, which led to increased cost of the handlebars. In view of this, we selected an alloy securing the strength by adding a large amount of zinc while reducing the amount of the copper, which deteriorates the extrusion productivity, to the minimum adding amount, in consideration of maintaining the stress corrosion cracking resistance. However, a large amount of zinc decreases the stress corrosion cracking resistance. Therefore, in order to obtain a metallic structure favorable to the prevention of stress corrosion cracking, the mandrel extrusion was applied for the pipe manufacturing method, and heat treatment condition and swaging condition were optimized. With this development, we have made it possible to manufacture the tapered handlebar made of high strength aluminum alloy with less weight by 20% and with lower cost by 30% than those of the conventional handlebar.

6. Paper No.(JSAE/SAE)	JSAE 20179125 / SAE 2017-32-0125
7. Paper title	Thin Wall Austempered Ductile Iron Connecting Rod for Lighter Automotive Component – Production of Thin Wall Ductile Iron Connecting Rod
8. Author (Affiliation)	Rianti Sulamet-Ariobimo, Gregah Yudha, Tono Sukarnoto, Yusep Mujalis, Yoska Oktaviano (Mechanical Engineering Department, Faculty of Industrial Technology, Universitas Trisakti, Jakarta, Indonesia)

9. Abstract

Lighter automotive components are produced to respond to global issue regarding energy. Lighter components can be achieved by replacing the material to those known as lighter material such as aluminium or applying thin wall casting technique. Lightweight automotive components will mean lower fuel consumption. Based on the success in making thin wall ductile iron plate (TWDI) with a thickness to 1 mm using a vertical casting, it encourages the implementation of the design to create lightweight automotive components. The design was applied to produce a thin wall two-cylinder engine ductile iron connecting rod which will be upgraded with austempering process. This connecting rod will be applied in Vespa PX150. The designs were simulated in ZCast simulation software and analyzed to determine the most optimum design. The chosen design was casted in a foundry to match the simulation. Evaluation of the characteristics will be run in the second stage of the research.

1. Date	November 15th Wednesday
2. Room.	C (Merak 3)
3. Time	15 : 30 - 17 : 30
4. Session	NVH Technology
5. Chair (Affiliation), co-chair (Affiliation)	Hiroshi Yano (Kawasaki Heavy Industries, Ltd.), Thomas Lagö (QirraSound Technologies Europe AB)

6. Paper No.(JSAE/SAE)	20179034 / 2017-32-0034
7. Paper title	Active Sound Quality Control based on Subjective Preference
8. Author (Affiliation)	Shunsuke Ishimitsu, Takuma Sagawa, Tomoaki Ito, Naoaki Shibatani (Hiroshima City University), Toshihisa Takagi, Kazuki Yoshida, Kenta Suzuki, Takanori Chino (Suzuki Motor Corporation)

9. Abstract

Recent years, ANC (Active Noise Control) technology has been paying attention. However, rather than the noise measures, the noise gives us the impression even running sound for motorcycles. That is, the control method of the engine sound is shifted from the noise reduction to sound design in each manufactures. Therefore, we proposed a method to design the engine sound using Active Sound Quality Control (ASQC) based on the ANC. Specifically, we proposed the algorithm amplifying and reducing the engine specific order components. From the simulation results, the engine specific order components can be amplified and reduced like an equalizer with the proposed algorithm. And, auditory impressions of engine sound controlled by ASQC were investigated using psychoacoustic measurements…

6. Paper No.(JSAE/SAE)	20179068 / 2017-32-0068
7. Paper title	Parallel active control of acceleration noise
8. Author (Affiliation)	Yoshihiro Aramaki, Shunsuke Ishimitsu, Kenta Murai (Hiroshima City University), Kazuki Yoshida, Toshihisa Takaki, Takanori Chino, Kenta Suzuki (Suzuki Motor Corporation)

9. Abstract

The number of people experiencing psychological discomfort due to the increasing amount of noise emanating from motor vehicles has been on the rise. Legal regulations define the permissible level of vehicle noise in a given area. Active noise control (ANC) is a noise cancellation method that reduces low-frequency sounds, such as engine noise, effectively. Furthermore, this method is suitable for controlling engine noise because the equipment necessary to perform it is small and does not require a large space for installation. Advances in digital processing technology have increased the scope of ANC's applications, and it is no longer restricted to use in motor vehicles. The purpose of this study is to demonstrate the effectiveness of the proposed method in reducing the motor vehicle engine noise produced during acceleration…

6. Paper No.(JSAE/SAE)	20179066 / 2017-32-0066
7. Paper title	Design and Performance of Acoustic Metamaterial Structure for Inlet Duct Noise Attenuation
8. Author (Affiliation)	Jüri Lavrentjev, Hans Rämmal (Tallinn University of Technology)

9. Abstract

To control noise emission from internal combustion inlet, designers often choose small chamber type silencers at the inlet. In order to improve the inlet acoustic efficiency, inlet ducts with improved acoustic attenuation can be used. One potentially applicable material is acoustic metamaterial rapidly gaining popularity in different fields of engineering application. Small engine inlet duct, designed by using acoustic metamaterial structure comprising an array of resonators inside the wall of a rigid duct is investigated in this study. Experimental investigation of different designs is performed to characterize the acoustic behavior in terms of transmission loss (TL). By connecting multiple resonators of different size and location it is shown that a broadband TL can be achieved. The resulted attenuation band can be tuned by varying the resonator physical characteristics, showing promising potentials such of the material in the described application.

6. Paper No.(JSAE/SAE)	20179075 / 2017-32-0075
7. Paper title	Reliability Study of Micro-Perforated Elements in Small Engine Silencer Application
8. Author (Affiliation)	Hans Rämmal, Jüri Lavrentjev (Tallinn University of Technology)

9. Abstract

Since the introduction of microperforated (MP) sound absorption elements more than 40 years ago many variations of noise control devices from room acoustics to induct applications have been manufactured based on this technology. It has been demonstrated that micro-perforated elements can provide adequate IC-engine gas exchange noise attenuation. Several exhaust and inlet system silencers incorporating micro-perforated elements have been presented during the past 15 years for engine applications, encouraging the replacement of the typical fibrous materials and aiming several advantages including cleaner environment. The acoustical characteristics of the MP elements have been studied thoroughly by several authors and good analytical models exist to predict the attenuation performance of those elements. However, almost no published information can be found regarding the reliability of the MP elements utilized in harsh engine exhaust system environment. In this paper the reliability of stainless still MP element designed for small engine exhaust systems is critically studied…

1. Date	November 15th Tuesday
2. Room.	D (Nuri 1)
3. Time	10:30-12:00
4. Session	Vehicle Dynamics & Safety　I
5. Chair (Affiliation), Co-chair (Affiliation)	Masayuki Baba (Honda R&D Co., Ltd.), Thomas Lago (QirraSound Technologies Europe AB)

6. Paper No.(JSAE/SAE)	20179018 / 2017-32-0018
7. Paper title	The Tire Characteristic Effect on Motorcycle Maneuverability Using a Riding Simulator
8. Author (Affiliation)	Masayuki Miki, Tetsuya Kimura (Yamaha Motor Co., Ltd)

9. Abstract

The stability factor is widely used for four-wheel vehicles as an index representing the turning performance of a vehicle. Stability factor for two-wheel vehicles has been proposed as an indicator of cornering performance from the same way of thinking. In line traceability evaluation as a sensory evaluation item of motorcycles, the expressions of understeer and oversteer are sometimes used, but the relation with stability factor for two-wheel vehicles has not been investigated. In this paper, a test in which the slip angle characteristics of the front and rear tires were varied using a riding simulator was conducted, and the correlation between the stability factor and the rider evaluation was investigated to derive an index showing the line traceability.

6. Paper No.(JSAE/SAE)	20179033 / 2017-32-0033
7. Paper title	Data Analysis of Off-Road Motorcycles in an Enduro Race
8. Author (Affiliation)	Akinori Shinagawa (Yamaha Motor Co., Ltd), Hisayuki Nozawa, Yutaro Uchiyama (Yamaha Motor Engineering Co., Ltd)

9. Abstract

Two-wheeled off-road vehicles are mainly ridden on slippery dirt roads that include steep slopes and rough, uneven surfaces. An analysis method for the driving state and the vehicle movement limits that would be suitable for analyzing the movement of such two-wheeled off-road vehicles under these conditions was examined. These movement limits were then formulated by taking into consideration the coefficient of friction and the road surface gradient in accordance with the basic laws of physics and also by focusing on the vehicle movement in the longitudinal direction. Measurements were also taken during actual off-road riding by top-class Japanese off-road motorcycle riders. It was confirmed that this measurement data was distributed within the range of the assumed vehicle movement limits. Consequently, it was confirmed that it is possible to use such measurements to accurately grasp the vehicle movement limits and the associated driving state for two-wheeled off-road vehicles.

6. Paper No.(JSAE/SAE)	20179053 / 2017-32-0053
7. Paper title	Investigation and Model-Based Compensation of the Pitch Dynamic Impact on Longitudinal Acceleration Measurement on Motorcycles
8. Author (Affiliation)	Alexander Winkler, Gernot Grabmair (University of Applied Sciences Upper Austria)

9. Abstract

In this study we focus on systematic disturbances caused by the motorcycle pitch dynamic when measuring longitudinal acceleration on motorcycles using low-cost acceleration sensors. Major systematic influences in the sensor measurement like gravitational acceleration, suspension dynamics and the road slope are addressed. During acceleration phases the motorcycle pitch angle changes according to the suspension setting. As a result the longitudinal sensing axis of the accelerometer includes parts of the gravitational acceleration and lags parts of the longitudinal acceleration. Gravitational acceleration has also significant influence on inclined roads. To obtain correct values of the effective longitudinal acceleration, the disturbances in the measured signal are analyzed and in further consequence compensated. For this purpose a linearized in-plane-dynamics model of the motorcycle is derived from a comprehensive multibody simulation. The mathematical description of the motorcycle behavior includes the systematic influences and serves as a basis for the model-based compensation. A state observer for pitch angle estimation and road slope reconstruction is designed. As a result the measured acceleration can be corrected with the estimated quantities. In the course of ongoing development of motorcycle dynamics control and advancement of drivetrains, e.g. hybridization, independent and economically measureable reference signals are required to achieve desired vehicle behavior with closedloop control. Acceleration measurement on two-wheelers can be achieved at low hardware cost and is a promising quantity for innovative control designs.

1. Date	November 15 th Tuesday
2. Room.	D (Nuri 1)
3. Time	13:30 – 15:00
4. Session	Vehicle Dynamics & Safety II
5. Chair (Affiliation), Co-chair (Affiliation)	Hisayuki Sugita (SUZUKI MOTOR CORPORATION), Sangriyadi Setio (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179086 / 2017-32-0086
7. Paper title	Development of Low Fuel Consumption Tire for Small Motorcycles
8. Author (Affiliation)	Shinji Takayanagi, Kiyotaka Sakai, Takashi Iwasa, Tomoyuki Matsumura, Shigehiro Yamaguchi, Kenji Tanaka (Honda R&D Co., Ltd.)

9. Abstract

A low fuel consumption tire with an affordable price that is applicable for small motorcycles marketed mainly for India and Southeast Asian countries was developed. Two contradicting requirements, which are reduction of the rolling resistance and retention of the wet grip performance, were satisfied by applying a method based on viscoelastic properties of the tread rubber. Regarding the composition of compound of the tread rubber, the amounts of carbon black and oil were reduced instead of using silica. In addition, a polymer having a high glass transition temperature was employed. Moreover, response to the roll motion, which is unique in motorcycles, was made satisfactory to the requirement by modifying the dynamic modulus E* of the tread rubber. With those measures, the rolling resistance was reduced by more than 15% to conventional tires while maintaining the basic performances such as tire grip and stability in maneuvering.

6. Paper No.(JSAE/SAE)	20179099 / 2017-32-0099
7. Paper title	Durability Prediction of Motorcycle Body Components Using Advanced Fatigue Analysis
8. Author (Affiliation)	Kazunobu Sakamoto (Yamaha Motor Co., Ltd)

9. Abstract

The purpose of this study is to improve the accuracy of durability predictions for motorcycle body components through the implementation of a fatigue analysis that uses the finite element method (FEM) to identify the fatigue failure characteristics of arc welds, die-cast aluminum alloys, and thermo-plastics. In addition to highly accurate load conditions and stress analysis, a fatigue analysis that also takes into consideration the fatigue failure mechanism is essential to making accurate durability predictions. Fatigue tests were carried out under several load conditions using specimens of several different shapes that simplified the actual structures. The fatigue life of the weld toe is assumed to be the difference of the crack propagation rate due to the loading mode. The durability of die-cast aluminum alloys was found to be sensitive to the microscopic structure due to the casting process. The factors that influenced the fatigue behavior of the plastics were the stress gradient and the viscoelastic behavior. These comprehensive fatigue characteristics were applied to the fatigue analysis codes fe-safe and FEMFAT. The master S-N curve approach was used to evaluate the fatigue of the weld zone. Then the correlation between the durability predictions and the actual life were analyzed under rough road running conditions. This procedure was found to be an effective means of accurately predicting the fatigue life of motorcycle body components.

1. Date	November 15th Wednesday
2. Room.	D (Nuri 1)
3. Time	15:30 - 17 :30
4. Session	Measurement & Simulation I
5. Chair (Affiliation), co-chair (Affiliation)	Tadao Okazaki (Kubota Corporation), Stephan Schmidt (Graz University of Technology)

6. Paper No.(JSAE/SAE)	20179020 / 2017-32-0020
7. Paper title	Measurement and 3D simulation for Analysis of Emission Improvement in Oil-cooled Engine
8. Author (Affiliation)	Koichi Tanaka, Kunio Arase, Amane Kitayama, Toru Shimizu, Akihisa Shimura (SUZUKI MOTOR CORPORATION)

9. Abstract

The aim of this study is to analyze the emission improvement in the oil-cooled engine by use of in-cylinder gas pressure measurement and 3D simulation of thermal flow and combustion. In previous study, two test engines were designed to evaluate the benefits of oil-cooled engine. One was the oil-cooled, and the other was water-cooled engine. Both engines were single cylinder engines with SOHC valve-train system. Their hardware specifications of engines were exactly same except for their cooling system for clarifying how the difference in engine cooling system affects their cooling performance, warm-up performance and emission performance...

6.Paper No.(JSAE/SAE)	20179130 / 2017-32-0130
7. Paper title	Knock tendency prediction in highly charged SI engines by the use of 3D-CFD simulation
8. Author (Affiliation)	Vincenzo Bevilacqua, Matthias Boeger, Giovanni Corvaglia, Matthias Penzel, Klaus Fuoss (Porsche Engineering Services GmbH)

9. Abstract

The continual increasing stringent requirements in terms of emissions and performance lead to the demand of further development of gasoline engines, in order to satisfy the regulations and to be competitive in the market. One of the main limits in the attempt of improving the efficiency and at the same time increasing the performance of an engine is the knock, which is the local auto-ignition of the air-fuel mixture before being reached by the flame front. Either this phenomenon limits the possibility to adopt higher compression ratio, which would be beneficial for the engine efficiency,□

6. Paper No.(JSAE/SAE)	20179036 / 2017-32-0036
7. Paper title	Development of a new comprehensive CFD method for thermal performance evaluation of a scooter type motorcycle and its application
8. Author (Affiliation)	Venkata suresh kumar gundavarapu, Manish garg, Suresh M (TVS Motor Company Limited)

9. Abstract

Thermal management is of vital importance in the development of a scooter type motorcycle (two-wheeler). For a typical small scooter, with cubic capacity of 75 to 150 cc, the thermal management can be sub-divided into three components, namely, engine cooling, transmission cooling and engine cabin cooling, where engine cabin consists of engine, utility box, fuel tank and fueling system, and electric wiring harness, etc. Maintaining adequate temperature of these subsystem is essential for engine and vehicle durability, and customer satisfaction□

6. Paper No.(JSAE/SAE)	20179067 / 2017-32-9067
7. Paper title	A 3D-CFD Study of Flow Dynamics on Mixture Preparation for Fuel Injected Motorcycles
8. Author (Affiliation)	Ranjana Kumari Meena, Adwitiya Dube, Pradeep Ramachandra (Bosch Limited)

9. Abstract

With the increased demand of mobility in the form of two-wheelers and the continued dominant share of Internal Combustion Engines (ICE) in Indian market, there is considerable influence on the deterioration of air quality. The regulators in this region have legislated Bharat Stage 6 (BS6) as a measure to reduce tail pipe emissions, which necessitates the automotive industry to work towards emission optimization measures. Some of the factors influencing this mainly includes, air-fuel mixture formation, spray targeting, fuel properties, flow dynamics, combustion chemical kinetics etc□

1. Date	November 15th Wednesday
2. Room.	E (Kakatua)
3. Time	10 : 30-12 : 00
4. Session	Diesel Engine I
5. Chair (Affiliation), Co-chair (Affiliation)	Tomoaki Yatsufusa (Hiroshima Institute of Technology), Iman K. Reksowardojo (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179046 / 2017-32-0046
7. Paper title	Improvement of Thermal Efficiency and Exhaust Emission in Diesel Engine by Applying Spray Internal EGR
8. Author (Affiliation)	Tomoyuki Mukayama, Ryota Nishigami, Annisa Bhikuning, Eriko Matsumura, Jiro Senda (Doshisha University), Go Asai, Masaki Kuribayashi(YANMAR CO., LTD.)

9. Abstract

The CO2 gas dissolved fuel for the diesel combustion is effective to lower the NOx emissions to achieve the internal EGR effect by fuel. This method is supply EGR gas to the fuel side instead of supply EGR gas to the intake gas side. The fuel has following specific characteristics for the diesel combustion. When the fuel is injected into the chamber in low pressure, this CO2 gas is separated from the fuel spray. The distribution characteristics of the spray is improved and the improvement of the thermal efficiency by reduction heat loss in the combustion chamber wall, and reduce soot emissions by the lean combustion is expected. Furthermore, this CO2 gas decreases the flame temperature. Further, it is anticipated to reduce NOx emissions by the spray internal EGR effect.

6. Paper No.(JSAE/SAE)	20179101/ 2017-32-0101
7. Paper title	The Effect of Exhaust Gas Recirculation on Performance and Emission of Ethanol Fumigated Diesel Engine
8. Author (Affiliation)	Kontorn Thammakul, Chinda Charoenphonphanich (King Mongkut's Institute of Technology Ladkrabang), Hidenori Kosaka(Tokyo Institute of Technology), Manida Tongroon(National Metal and Materials Technology Center)

9. Abstract

Primary energy source such as fossil fuel keep decreasing due to various kind of usage. According to less amount of the fossil fuel, human seeks for an alternative fuel source such as alcohol. Alcohol like ethanol can be produced easily from strarchy plant. But using alcohol as blended fuel with diesel fuel doesn't work well because alcohol has low cetane number, lack of lubricity and very low miscibility with diesel fuel. To overcome this, fumigation system or port fuel injection of alcohol seems interesting. Although it requires more complicate system but it can compensate the miscibility issue and alcohol can be used in higher dose to give more energy. Diesel engine produces a lot of emission such as NOx and some other carbon content emission like HC, CO and soot due to they run in lean condition as their characteristic. Modern diesel engines are now coupled with exhaust gas recirculation system to help reduce in main emission like NOx. But recirculating an exhaust into combustion system will produce emission like HC and other carbon content emission more. Due to EGR will retard the pressure and the temperature of the combustion, lower work is provided. Alcohol requires heat to vaporize itself to become more radical before associating with other atoms and going into combustion process. So heat from the exhaust gas in EGR could be helpful for alcohol fumigation system by treating combustion process to produce better performance and emission. The result would be observed by conducting an experiment on a single cylinder diesel-direct injection engine, with EGR modification and ethanol fumigation system….

6. Paper No.(JSAE/SAE)	20179089 / 2017-32-0089
7. Paper title	Development of 2-cylinder Diesel Engine for European quadricycle in compliance with EURO4
8. Author (Affiliation)	Hiroki Oso, Kentaro Nagai, Takahiro Yamazaki, Hideyuki Goto, Hideyuki Koyama (Kubota Corporation)

9. Abstract

The EURO4 standard has been enforced since the year 2017 for European quadricycle. The vehicles are regulated upper limit of unladen weight and engine displacement, in addition to the exhaust emissions and the net power. In order to meet those regulations, the engine for European quadricycle is demanded low exhaust emissions and light weight. Further, it is required to be achieved good drivability, low fuel consumption, low noise and more compact. We introduce technologies to meet demand for Euopean quadricycle in compliance with EURO4. The limit values of exhaust emissions have been strengthened in EURO4 standard compared to the previous one. As devices to improve the exhaust emissions, the exhaust-after-treatment devices and the common rail injection system are well known, whereas those devices make engine systems heavier. In addition, to satisfy high torque at low speed for better drivability, larger displacement is effective. However the engines of larger displacement have higher friction loss than smaller one, therefore countermeasures to reduce fuel consumption are necessary. In order to achieve to be lower emissions without additional devices, we improved the in-direct injectionsystem engine. We optimized the shape of the combustion chamber to meet EURO4. To achieve low fuel consumption keeping better drivability with large displacement, wedeveloped the new piston to be lower friction. We optimized the shape of the coating pattern to improve lubrication between piston skirt and cylinder wall…

1. Date	November 15th Wednesday
2. Room.	E (Kakatua)
3. Time	13:30 – 15:00
4. Session	Diesel Engine II
5. Chair (Affiliation), Co-chair (Affiliation)	Tadao Okazaki (Kubota Corporation), Iman K. Reksowardojo (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179030/ 2017-32-0030
7. Paper title	Effect of heat flux on end of Diesel and Kerosene droplet evaporation in high temperature condition
8. Author (Affiliation)	Yoshihide Ota, Hirishi Enomoto, Jun Higashihara, Masahiro Sasao, Noboru Hieda, Yoshikazu Teraoka (Kanazawa University)

9. Abstract

In internal combustion engine, it is necessary to grasp droplet evaporation for using liquid fuel efficiency and improving exhaust gas composition. However, it has not known completely yet. In this study, fuel droplet of approximately 20μm diameter that is assumed to be in combustion chamber is injected by experimental apparatus. After that, droplet goes to butane flame. We observed by high-speed camera, and experimentally considered the effects of heat flux on the fuel droplet evaporation and breakup phenomenon. For the sample fuel, we use kerosene and diesel oil. It is important for understanding evaporation condition to know temperature around droplet in butane flame. Thus, flame temperature is measured by sheathed thermocouple. Heat flux is changed by initial velocity. From experiment, we found some result. Time that from injector tube to location of breakup of the droplet is short by increasing heat flux. In terms of breakup phenomenon, it is found that kerosene is broken up in relatively small heat flux condition. The breakup diameter is not dependent on heat flux. Evaporation rate is increased linearly by increase in heat flux. The value of evaporation rate that kerosene and diesel oil is almost equal.

6. Paper No.(JSAE/SAE)	20179035 / 2017-32-0035
7. Paper title	Influence of pressure conditions in supercritical atmosphere on flame diameter of Diesel oil and Hexadecane droplet
8. Author (Affiliation)	Takuya Mino, Enomoto Hiroshi, Teraoka Yoshikazu, Hieda Noboru, Sasao Masahiro, Higashihara jun (Kanazawa University)

9. Abstract

Liquid fossil fuels such as gasoline, diesel oil, and kerosene are widely used as a fuel of various transportation apparatus and generating electricity apparatuses including the automobiles. The spray combustion has been widely used for internal combustion engine to use the fuel efficiently. But some parts of the phenomenon are not elucidated because this combustion method is complicated phenomenon. To elucidate this phenomenon, there are many ways of analyzing droplet. For example, observing a single droplet which suspended by a catenary or under the microgravity. However, those methods are not enough simulation of a real droplet in the internal combustion engine. In this study, we developed an apparatus which couldinject a freedom droplet of diameter about 30μm. It is considered that the droplet is in a real internal combustion engine. And the apparatus was installed in a container which could realize elevated temperature and pressure. And a droplet was injected under supercritical condition that simulated the condition in the internal combustion engine and combustion behavior was observed. We experimented with Diesel oil and hexadecane which is a surrogate fuel of Diesel oil. The influences of the combustion area of the droplet, the burning time, and the luminance value at the time of combustion were investigated. As a result, it was found that when the same fuel was burned under the same temperature condition under the supercritical condition, the maximum combustion area increased.

6. Paper No.(JSAE/SAE)	20179032 / 2017-32-0032
7. Paper title	Characteristics of Flat-Wall Impinging Spray Flame and Its HeatTransfer under Small Diesel Engine-Like Condition
8. Author (Affiliation)	Rizal Mahmud, Seong Bum Kim, keiya Nishida, Yoichi Ogata(Hiroshima University), Jun Kanzaki, Tadashi Tadokoro(Mazda Motor Corporation), Toru Kurisu (Hiroshima University/ Mazda Motor Corporation)

9. Abstract

Heat loss is more critical for the thermal efficiency improvement in small size diesel engines than large-size diesel engines. More than half of total heat energy in the internal-combustion engine is lost by cooling through the cylinder walls to the atmosphere and the exhaust gas. Therefore, the new combustion concept is needed to reduce losses in the cylinder wall. In a Direct Injection (DI) diesel engine, the spray behavior, including spray-wall impingement has an important role in the combustion development to reduce heat loss. The aim of this study is to understand the mechanism of the heat transfer from the spray and flame to the impinging wall. Experiments were performed in a constant volume vessel (CVV) at high pressures and high temperatures. Fuel was injected using a single-hole injector with a 0.133 mm diameter nozzle. Under these conditions, spray evaporates, then burns near the wall. Spray/flame behavior was investigated with a highspeed video camera. At the same time, the surface heat flux of the impingement wall was studied by three thin film thermocouple heat flux sensors. The results showed that local heat flux becomes a maximum at some spray impingement distances to the wall.

1. Date	November 15th Wednesday
2. Room.	E (Kakatua)
3. Time	15:30 – 17:30
4. Session	Diesel Engine III
5. Chair (Affiliation), Co-chair (Affiliation)	Keiya Nishida (Hiroshima University), Iman K. Reksowardojo (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179105 / 2017-32-0105
7. Paper title	Dynamic Modeling of a Diesel Oxidation Catalyst and Diesel Particulate Filter Aftertreatment System for Regeneration Control Development
8. Author (Affiliation)	Chia-Jui Chiang, T. F. Kuo, Anton Halim (National Taiwan University of Science and Technology), S. C. Cheng, Y.Y. Ku(Automotive Research and Testing Center)

9. Abstract

The main function of diesel particulate filter (DPF) is to remove the particulate matter (PM) from diesel engine emission. However, the accumulated PM restricts the exhaust flow through the DPF and increases the back pressure which may negatively impact fuel consumption. Therefore, the particulate filter needs to be regenerated by burning off the accumulated particulate, which is achieved either by passively use of a catalyst or by actively introducing high heat into the exhaust system. In the exhaust after treatment system considered in this paper, a diesel oxidation catalyst (DOC) is installed upstream of the DPF to facilitate the regeneration process. In order to combust the captured particulate in the DPF, a small amount of fuel can be injected into the exhaust, upstream of the DOC, when necessary. In an effort to develop a model-based control strategy which completes the regeneration while satisfies the constraints such as fuel consumption, temperature and regeneration period, a physics-based dynamic model of the DOC-DPF exhaust after treatment system is proposed. Parameters in the model including the heat transfer coefficient, reaction constants in the DOC and DPF, and the permeability of the filter and soot are identified based on the experimental measurements. The DOC-DPF model is then validated both at steady state and during transient against experimental data measured at various engine operating conditions, PM loads and fuel injection rates.

6. Paper No.(JSAE/SAE)	20179107 / 2017-32-0107
7. Paper title	Model-based Analysis of the Oscillatory NOx in Urea Selective Catalytic Reduction Systems
8. Author (Affiliation)	Chih-Cheng Chou (National Defense University) T. F. Kuo, T. H. Tsai, Y. H. Su(National Taiwan University of Science and Technology), Y. Y. Ku(Automotive Research and Testing Center)

9. Abstract

The urea-water-solution based selective catalyst reduction (SCR) system is one of the effective devices for reduction of NOx from diesel engines. In an effort to understand the various levels of oscillation observed in the NOx measurement downstream of a SCR in which the urea dosage is controlled by a crankshaft-link pump, a zerodimensional dynamic SCR model is developed in this paper based on conservation of mass. The model contains three states including the concentrations of NOx and ammonia in the SCR and the surface coverage rate of the catalyst. The temperature-dependent reactions considered in the model include the adsorption, desorption and oxidation of ammonia and the NOx reduction with the reaction constants provided by the catalyst company. The dynamic SCR model is validated both at steady state and during transient under various engine operating conditions and urea dosing rates. A periodic modulation of the urea dosing rate is adopted to simulate the periodic urea supply resulted from the reciprocating motion of the crankshaft-link pump. The simulation results exhibit similar oscillatory behaviors in the NOx concentration as observed in the experimental measurement, which is further analyzed and explained based on the nonlinear characteristics between the downstream NOx and the ammonia dosage. Based on the interpretation of the oscillatory NOx signal, an algorithm for identification of the cross-sensitivity of the smart NOx sensor to ammonia is proposed.

6. Paper No.(JSAE/SAE)	20179115 / 2017-32-0115
7. Paper title	Heat Transfer Analysis in a Diesel Engine Based on a Heat Flux Measurement using a Rapid Compression and Expansion Machine
8. Author (Affiliation)	Tatsuya Kuboyama, Yasuo Moriyoshi(Chiba University), Hidenori Kosaka(Tokyo Institute of Technolody)

9. Abstract

To investigate the heat transfer phenomena inside the combustion chamber of a diesel engine, local heat flux on the piston surface of a rapid compression and expansion machine was measured using a thin-film thermocouple. Based on the measured heat flux on the piston surface, a correlation for the heat transfer coefficient in a combustion chamber of a diesel engine was investigated. In the correlation defined in the present study, thermodynamically estimated two-zone temperatures in the burned zone and the unburned zone are applied. The characteristic velocity given in the correlation is related to the speed of spray flame impinging on the wall during the fuel injection period. After the fuel injection period, the velocity term of the Woschni's equation is applied. It was shown that the proposed correlation well expresses heat transfer phenomena in diesel engines.

1. Date	November 16th Thursday
2. Room.	A (Merak 1)
3. Time	13:00-14:30
4. Session	Advanced Combustion　I
5. Chair (Affiliation), Co-chair (Affiliation)	Akihito Kasai (Honda R&D Co., Ltd.), Simona Silvia Merola (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179050 / 2017-32-0050
7. Paper title	A Study of Autoignition Behavior and Knock Intensity in a SI Engine under Different Engine Speed by using In-cylinder Visualization
8. Author (Affiliation)	Shuhei Takahata, Akira Iijima, Hideo Shoji, Kento Shimizu, Takahiro Ishikawa, Takuya Izako, Takahiro Yamashita, Hiroki Kudo(Nihon University)

9. Abstract

Internal combustion engines have been required to achieve even higher efficiency in recent years in order to address environmental concerns. However, knock induced by abnormal combustion in spark-ignition engines has impeded efforts to attain higher efficiency. Knock characteristics during abnormal combustion were investigated in this study by in-cylinder visualization and spectroscopic measurements using a four-stroke air-cooled single-cylinder engine. The results revealed that knock intensity and the manner in which the autoignited flame propagated in the end gas differed depending on the engine speed.

6. Paper No.(JSAE/SAE)	20179112 / 2017-32-0112
7. Paper title	The Effect of Fuel Composition on Ignition Delay and Knocking in Lean Burn SI Engine
8. Author (Affiliation)	Yasunobu Goto, Dongwon Jung, Toshihisa Ueda, Norimasa Iida (Keio University)

9. Abstract

Super lean burn technology is conceived as one of methods for improving the thermal efficiency of SI engines [1] [2]. For lean burn, reduction of heat loss and the due to decrease in flame temperature can be expected. However, as the premixed gas dilutes, the combustion speed decreases, so the combustion fluctuation between cycles increases. Also, to improve the thermal efficiency, the ignition timing is advanced to advance the combustion phase. However, when the combustion phase is excessively advanced, knocking occurs, which hinders the improvement of thermal efficiency. Knocking is a phenomenon in which unburned gas in a combustion chamber compressed by a piston and combustion gas suffer compression auto-ignition. It is necessary to avoid knocking because the amplitude of the large pressure wave may cause noise and damage to the engine. Also, knocking is not a steady phenomenon but a phenomenon that fluctuates from cycle to cycle. Many studies have already been made on the knocking characteristics that occurred during stoichiometric combustion [3], but there have been no reports on knocking characteristics in super lean burn near the excess air ratio of 2.0. In order to establish super lean burn technology it is essential to grasp the knocking characteristics of super lean burn. In this research, we aim to clarify the factors that fuel composition affects auto-ignition of unburned gas using SIP common 5 component surrogate fuel.

6. Paper No.(JSAE/SAE)	20179118 / 2017-32-0118
7. Paper title	Study on the Suppression of Pressure Wave at Spontaneous Ignition of Gasoline Surrogate Mixture in a Rapid Compression Machine
8. Author (Affiliation)	Kohei Honda, Yusuke Miyauchi, Yusuke Usami, Ryohei Toyoda, Koki Yoshida, Masanori Saito, Akira Iijma, Mitsuaki Tanabe (Nihon University)

9. Abstract

Factor of pressure wave growth due to spontaneous ignition is clarified and method of suppressing strong pressure wave is proposed. Experiments of compression ignition of premixed gas were made and relationship among autoignitive propagation velocity, heat release rate and pressure wave due to spontaneous ignition of end gas was quantitatively evaluated using a Super Rapid Compression Machine (SRCM)[1 ~ 3]. The gasoline surrogate composed of iso-octane, normal-heptane, methyl cyclohexane, diisobutylene and toluene was used for fuel. As a result, it was found that the growth of the pressure wave at the spontaneous ignition depends on autoignitive propagation velocity and the heat release. The pressure amplitude is reduced with decreasing autoignitive propagation velocity and heat release rate. To suppress the strong pressure wave by realizing high temperature gradient with vortices in cylinder, turbulent condition whose turbulent intensity is about 3 m/s was applied. It was found that the strong pressure wave can be suppressed by the turbulence.

1. Date	November 16th Thursday
2. Room.	A (Merak 1)
3. Time	15:00-16:30
4. Session	Advanced Combustion II
5. Chair (Affiliation), Co-chair (Affiliation)	Akihito Kasai (Honda R&D Co., Ltd.), Simona Silvia Merola (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179119 / 2017-32-0119
7. Paper title	Analysis of Interaction between Autoignition and Strong Pressure Wave Formation during Knock in a Supercharged SI Engine based on High Speed Photography of the End Gas
8. Author (Affiliation)	Akira Iijima, Takuya Izako, Takahiro Ishikawa, Takahiro Yamashita, Shuhei Takahata, Hiroki Kudo, Kento Shimizu, Mitsuaki Tanabe, Hideo Shoji(Nihon University)

9. Abstract

Engine knock is the one of the main issues to be addressed indeveloping high-efficiency spark-ignition (SI) engines. In order to improve the thermal efficiency of SI engines, it is necessary to develop effective means of suppressing knock. For that purpose, it is necessary to clarify the mechanism generating pressure waves in the end-gas region. This study examined the mechanism producing pressure waves in the end-gas autoignition process during SI engine knock by using an optically accessible engine. Occurrence of local autoignition and its development process to the generation of pressures waves were analyzed under several levels of knock intensity. The results made the following points clear. It was observed that end-gas autoignition seemingly progressed in a manner resembling propagation due to the temperature distribution that naturally formed in the combustion chamber. Stronger knock tended to occur as the apparent propagation speed of autoignition increased. It is particularly notable that a condition was observed in which the apparent propagation speed of autoignition through the end gas clearly exceeded the speed of sound. Exceptionally strong knock occurred at that time. The measured results for the actual development of autoignition made it clear that extremely strong knock, such as what occurs under high-speed, high-load operation and also that induced by low-speed pre-ignition (LSPI) in a super charged downsized engine under low-speed, high-load operation (Super-Knock), is presumably caused by such phenomena. In other word, extremely strong knock is caused by detonation phenomena produced in auto ignition process.

6. Paper No.(JSAE/SAE)	20179091 / 2017-32-0091
7. Paper title	The Possibility for Realization of Dual Combustion Cycle for Spark Ignition Engine
8. Author (Affiliation)	Koji Yoshida (College of Science and Technology, Nihon University)

9. Abstract

The purpose of this study is to operate the spark ignition engine by the dual combustion cycle. The dual combustion cycle has two combustion processes; these are the constant volume combustion and the constant pressure combustion. The lean combustion and the direct fuel injection were applied to realize the dual combustion cycle for spark ignition engines. The combustion of lean mixture was corresponding to the constant volume combustion. The fuel was directly injected to combustion chamber and was burned with the remained oxygen after the lean combustion, so that this was corresponding to the constant pressure diffusion combustion. The combustion experiments were conducted by using the constant volume vessel. The lean propane-air mixture of which equivalence ratios were 0.6, 0.7, 0.8 and 0.9 were used and liquid n-heptane was injected by using the high-voltage electrical discharge.

6. Paper No.(JSAE/SAE)	20179120 / 2017-32-0120
7. Paper title	Chemical Reaction Processes of Fuel Reformation by Diesel Engine Piston Compression of Rich Homogeneous Air-Fuel Mixture
8. Author (Affiliation)	Go Asai(YANMAR Co., Ltd.), yusuke Watanabe, Shuntaro Ishiguro, Gen Shibata, Hideyuki Ogawa, Yoshimitsu Kobashi(Hokkaido University)

9. Abstract

To extend the operational range of premixed diesel combustion, fuel reformation by piston induced compression of rich homogeneous air-fuel mixtures was conducted in this study. Reformed gas compositions and chemical processes were first simulated with the chemistry dynamics simulation, CHEMKIN Pro, by changing the intake oxygen content, intake air temperature, and compression ratio. A single cylinder diesel engine was utilized to verify the simulation results. With the simulation and experiments, the characteristics of the reformed gas with respect to the reformer cylinder operating condition were obtained. Further, the thermal decomposition and partial oxidation reaction mechanisms of the fuel in extremely low oxygen concentrations were obtained with the characteristics of the gas production at the various reaction temperatures.

The main reformed products were hydrogen (H2), carbon monoxide (CO), carbon dioxide (CO2), methane (CH4), and ethylene (C2H4) and the results indicated that the reforming depends on the maximum temperature in the cylinder, however, the amount of reformed gas is lower than the values predicted by the CHEMKIN simulation.

1. Date	November 16th Thursday
2. Room.	B (Merak 2)
3. Time	13 : 00-14 : 30
4. Session	Alternative Fuels　I
5. Chair (Affiliation), Co-chair (Affiliation)	Toru Nakazono (LEMA / YANMAR Co., Ltd.), Iman K. Reksowardojo (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179070/2017-32-070
7. Paper title	Thermodynamic Loss Analysis of a high power motorcycle engine with focus on alcohol blended fuels
8. Author (Affiliation)	Stephan Anton Jandl, Patrick Pertl , Hans-Juergen Schacht , Stephan Schmidt (Graz University of Technology) Stefan Leiber(BRP-Powertrain GmbH & Co KG)

9. Abstract

The development of future internal combustion engines and fuels is influenced by decreasing energy resources, restriction of emission legislation and increasing environmental awareness of humanity. Alternative renewable fuels have, in dependency on their physical and chemical properties, the production process and raw material, the potential to contribute a better well-to-wheel-CO2-emission-balance in automotive and non-automotive applications.
The focus of this research is the usage of alcohol fuels like ethanol and 2-butanol in non-automotive high power engines. The different propulsion systems and operation scenarios of non-automotive applications in comparison to automotive applications raise the need for specific research in this area.

6. Paper No.(JSAE/SAE)	20179078/2017-32-0078
7. Paper title	Optical Analysis in Alcohol-Blended Fuels on the Mixture Preparation and Combustion Behaviour of Small Two-Stroke SI Engines
8. Author (Affiliation)	Justus Wessling, Fabian Titus , Fabian Rauber , Justus Wessling , Kai W. Beck (MOT GmbH) Tim Gegg, Tilmann Seidel, Florian Schumann(ANDREAS STIHL AG & Co. KG)

9. Abstract

Small gasoline engines are used in motorcycles and handheld machinery, because of their high power density, low cost and compact design. The reduction of hydrocarbon emissions and fuel consumption is an important factor regarding the upcoming emission standards and operational expenses. The scavenging process of the two-stroke engine causes scavenging losses [1]. A reduction in hydrocarbon emissions due to scavenging losses can be achieved through a better understanding of the inner mixture formation. The time frame for fuel vaporization is limited using two-stroke SI engines by the high number of revolutions. With crank angle resolved optical methods it is possible to analyze the mixture formation behavior and combustion. A topic of these investigations is the use of alternative fuels such as alcohol- or butanol-blends and the analysis of their impact on the engine behavior. These fuels show high potential for further reduction of exhaust emission

6. Paper No.(JSAE/SAE)	20179092/2017-32-0092
7. Paper title	Spectroscopic investigation of initial combustion stages in a SI engine fuelled with ethanol and gasoline.
8. Author (Affiliation)	Adrian Irimescu, Silvana Di Iorio , Simona Silvia Merola , Paolo Sementa , Bianca Maria Vaglieco (Istituto Motori)

9. Abstract

It is well known that ethanol can be used in spark-ignition (SI) engines as a pure fuel or blended with gasoline. High enthalpy of vaporization of alcohols can affect air-fuel mixture formation prior to ignition and may form thicker liquid films around the intake valves, on the cylinder wall and piston crown. These liquid films can result in mixture non-homogeneities inside the combustion chamber and hence strongly influence the cyclic variability of early combustion stages. Starting from these considerations, the paper reports an experimental study of the initial phases of the combustion process in a single cylinder SI engine fueled with commercial gasoline and anhydrous ethanol, as well as their blend (50%vol alcohol). The engine was optically accessible and equipped with the cylinder head of a commercial power unit for two-wheel applications, with the same geometrical specifications (bore, stroke, compression ratio). Ultra-violet (UV) natural emission spectroscopy measurements ranging from 250nm to 470nm wavelength and simultaneous thermodynamic analysis were used to better understand the effect of ethanol content on flame kernel inception and development. All experiments were conducted at wide open throttle (WOT), with stoichiometric air-fuel mixtures, fixing the engine speed at 2000rpm. Optical investigations allowed to follow the evolution of chemical species that marked the spark discharge (cyano CN and hydroxyl OH radicals) as well as flame front initial growth (OH and carbyne CH radicals). Vibrational and rotational temperatures were calculated during the arc and glow phase by the ratio between the emission intensity of CN and OH radicals.

1. Date	November 16th Thursday
2. Room.	B (Merak 2)
3. Time	15 : 00-16 : 00
4. Session	Alternative Fuels II
5. Chair (Affiliation), Co-chair (Affiliation)	Hiroya Ueda (Honda R&D Co., Ltd.) Ken Fosaaen (Kerdea Technologies)

6. Paper No.(JSAE/SAE)	20179054 / 2017-32-0054
7. Paper title	The Effect of Gasoline-Ethanol Blended on Performance and Emission of a Fuel Injection Motorcycle 115 cc with Automatic Transmission in Indonesia
8. Author (Affiliation)	Iman Kartolaksono Reksowardojo, Phonethip Trichanh, Kevin Ferdyamin, Mega Zulfikar Akbar(Institut Teknologi Bandung)

9. Abstract

Ethanol is a renewable energy source derived from plants and its mixture of gasoline is already widely used to replace fossil fuel. This research aims to investigate the effect of ethanol blends with pure gasoline to the rate of fuel consumption and emissions of fuel injection motorcycle 115 cc with automatic transmission which is the population is dominant in Indonesia. Variations of the bioethanol mixture are 0%, 5%, 10%, and 20% ethanol. The experiment conducted in two different conditions by using three ways catalytic converter (TWC) in the exhaust pipe and without using TWC in exhaust pipe. First, The AFR is set in stoichiometry condition ($\lambda = 1$) and ignition timing set in MBT timing using modified ECU. Second, the quality of mixture has leaner AFR and standard timing ignition. The experiment performed on the chassis dynamometer and refers on the standard cycle ECE 15.

The results of this experiment showed that increment of ethanol content in the fuel makes the rate of fuel consumption and CO2 emission both increased but CO and HC emissions decreased. The use of modified ECU makes the rate of fuel consumption is higher because of richer AFR, but the emissions of HC and CO emission were lower compared to unmodified ECU. The lowest NOx emission in modified ECU resulted from E10 fuel while in original ECU resulted from E5

1. Date	November 16 th Thursday
2. Room.	C (Merak 3)
3. Time	13:00 - 14 :30
4. Session	Emissions&Environmental Impact　I
5. Chair (Affiliation), co-chair (Affiliation)	Hiromi Deguchi (SUZUKI MOTOR CORPORATION), Kai Beck (STIHL)

6. Paper No.(JSAE/SAE)	20179009 / 2017-32-0009
7. Paper title	A theoretical study of interaction between platinum and oxide support for exhaust gas purification catalyst
8. Author (Affiliation)	Kazuya Miura, Toyofumi Tsuda, Akio Hikasa, Hiroyuki Minokoshi, Fumikazu Kimata(Suzuki Motor Corp), Ryo Watanabe, Choji Fukuhara(Shizuoka University)

9. Abstract

We researched the interaction between the platinum and an oxide support by the HSAB (Hard-Soft-Acid-Base) concept, to obtain the guideline for superior exhaust-gas purification catalyst. The Density Functional Theory (DFT) calculation provided the chemical potential and chemical hardness via the eigenvalue of the Valence Band Maximum and Conduction Band Minimum. Moreover, it was found that the interaction depends on the chemical potential and chemical hardness, e.g., the metallic Pt cluster (Pt1, Pt3) had a greater interaction with the support oxide having a lower chemical hardness, on the other hand, the oxidized Pt cluster (Pt1O1, Pt1O2, Pt1O3, Pt1O4, Pt3O6) tends to be stabilized on the support oxide with a higher chemical potential. These results could be explained by the HSAB concept. It was also found that the oxidation energy of the supported Pt cluster corresponds well to the actual valency of the supported Pt, furthermore, the particle size of the Pt after the thermal treatment depends on the chemical potential. □ ..

6.Paper No.(JSAE/SAE)	20179011 / 2017-32-0011
7. Paper title	Study of Ion current application for misfire detection in motorcycle application
8. Author (Affiliation)	Lorenzo Mucciarella, Alberto Grimaldi, Francesco Virgilii (Eldor Corporation)

9. Abstract

Concerning internal combustion engine, the analysis and evaluation of combustion quality and pollutant agents raised to the attention of public opinion and worldwide authorities. Moreover the quality of the combustion of IC engine affects the insight of bike/car also from the customer point of view. The possibility to monitor engine behavior is a target that every car/motorcycle OEM is seeking to withstand legislated pollutant limit. As requested from EURO V OBD Stage II, starting from 2020 year it will be requested to monitor all the emission related components. In particular the legislator request to monitor the frequency of misfire, because of possible damages to catalyzer, in fact damages to this component can dramatically affect pollutant emission to the tail pipe. This article introduces a method for combustion quality and misfire monitoring for motorcycle engine based on ion current flowing in an electronic circuit in which the sensing element is the common spark plug. It is well known that motorcycle engine characteristics as increased speed, low inertia and chain transmission represent limits and challenges for conventional misfire monitoring based on engine speed sensor. The aim of the paper is to demonstrate that the use of ion current for combustion analysis is suitable and reliable for motorcycle application. □ ..

6. Paper No.(JSAE/SAE)	20179116 / 2017-32-0116
7. Paper title	Effect of Coolant Water and Intake Air Temperatures on Thermal Efficiency of Gasoline Engines
8. Author (Affiliation)	Naohiro Hasegawa, Yasuo Moriyoshi, Tatsuya Kuboyama(Chiba Univercity), Mitsuru Iwasaki(Calsonic Kansei Corporation)

9. Abstract

It is prospected that SI gasoline engine will still play an important role as a power source in the next 30 years, and the improvement of thermal efficiency of SI gasoline engine is strongly demanded. Recently, various technologies like the increasing compression ratio, direct injection and supercharged downsizing are developed to improve the thermal efficiency. These approaches normally result in the extra complex structures and increasing cost by required supplement of some devices. For small general purpose engines, it is difficult to use these approaches leading to complex structure and initial cost increasing from the view point of mountability, portability, robustness and economy. On the other hand, the optimization of thermal system management might improve the thermal efficiency without the large changes from conventional structure and increasing cost much. In the past study, it was indicated that changing coolant temperature by engine running conditions, not keeping coolant temperature to a constant, was possible to obtain a better thermal efficiency. Increasing compression ratio is considered as one of the effective approaches to improve the thermal efficiency, but knocking suppression is necessary. Cooling engine is effective to suppress the knock, but an excess of cooling engine leads to the increasing heat loss. Then the study that improvement of anti-knock capability by lowering coolant temperature of the engine partially which restrained the cylinder temperature was reported. □ ..

1. Date	November 16th Thursday
2. Room.	C (Merak 3)
3. Time	15:00 - 16:30
4. Session	Emissions&Environmental Impact II
5. Chair (Affiliation), co-chair (Affiliation)	Hiromi Deguchi (SUZUKI MOTOR CORPORATION), Kai Beck (STIHL)

6. Paper No.(JSAE/SAE)	20179041 / 2017-32-0041
7. Paper title	Current findings in measurement technology and measurement methodology for RDE and fuel consumption for two-wheeler-applications
8. Author (Affiliation)	Johannes Hiesmayr, Roland Kirchberger, Stephan Schmidt, Christian Zinner, Patrick Filips, Stefan Hausberger (Graz University of Technology), Roland Wanker, Hubert Friedl(AVL List GmbH)

9. Abstract

In recent times it turned out that real world operating scenarios have a major influence on regulation and homologation of emissions and fuel consumption. Having in mind the worldwide ambitions to reduce emissions of climate-relevant and environmentally harmful gases and the exploitation of fossil resources, deep understanding concerning the real drive behavior of mobile sources has to be acquired. It is a well-known fact that emissions and fuel consumption of e.g. passenger cars, operated in real world conditions, considerably differ from the officially published values.
There will be officially regulated emissions by the European Commission by means of real driving scenarios for passenger cars and commercial vehicles certified by Euro 6d from September 2017. A methodology to measure RDE real drive emissions is therefore well approved for heavy duty vehicles and automotive applications but may not be adapted similar to two-wheeler-applications. This is because of several arguments, like changing the vehicle dynamic when using a state of the art PEMS portable emission measurement system or due to the limited period of the year to be able to measure on-road with motorcycles in Europe, among others. …..

6. Paper No.(JSAE/SAE)	20179042 / 2017-32-0042
7. Paper title	Results, assessment and legislative relevance of RDE and fuel consumption measurements of two-wheeler-applications
8. Author (Affiliation)	Johannes Hiesmayr, Roland Kirchberger, Stephan Schmidt, Christian Zinner, Patrick Filips, Stefan Hausberger (Graz University of Technology), Roland Wanker, Hubert Friedl(AVL List GmbH)

9. Abstract

In recent times it turned out that real world operating scenarios have a major influence on regulation and homologation of emissions and fuel consumption. Having in mind the worldwide ambitions to reduce emissions of climate-relevant and environmentally harmful gases and the exploitation of fossil resources, deep understanding concerning the real drive behavior of mobile sources has to be acquired. It is a well-known fact that emissions and fuel consumption of e.g. passenger cars, operated in real world conditions, considerably differ from the officially published values.
There will be officially regulated emissions by the European Commission by means of real driving scenarios for passenger cars and commercial vehicles certified by Euro 6d from September 2017. A methodology to measure RDE real drive emissions is therefore well approved for heavy duty vehicles and automotive applications but was not adapted for two-wheeler-applications yet. Hence measurements have been performed for motorcycles with the state of the art measurement equipment at the Graz University of Technology to be prepared for possible future legislation.
Three four stroke petrol engine motorcycles were driven by four different riders on selected road segments that are representative for parts of mentioned real drive scenarios. Measurements at established on-road test cycles for passenger cars and chassis dynamometer measurements for comparison have been performed additionally. …..

1. Date	November 16th Thursday
2. Room.	D (Nuri 1)
3. Time	13:00 – 14:30
4. Session	Measurement & Simulation II
5. Chair (Affiliation), Co-chair (Affiliation)	Michihisa Nakagawa (Kawasaki Heavy Industries, Ltd.) Stephan Schmidt (Graz University of Technology)

6. Paper No.(JSAE/SAE)	20179027 / 2017-32-0027
7. Paper title	Numerical Transient Thermo-Mechanical Analysis of Cylinder Head and Valve within a 400cc Engine
8. Author (Affiliation)	Chien-Hsiung Tsai(National Pingtung University of Science and Technology), Hui-Hui Huang(Kun Shan University), Wei-Chun Chang(National Pingtung University of Science and Technology)

9. Abstract

In this paper, the temperature of coupling system including cylinder, head, inlet/exhaust valve, and the cooling jacket of a 400cc engine is investigated by computational fluid dynamic (CFD) method. Firstly, the total pressure loss of water jacket, radiator, and thermostat is calculated first, and then the mass flow rate inside the cooling system can be determined by fitting the water pump's performance curve (P-Q curve). The thermal boundary conditions for analysis of conjugate heat transfer of cooling system, such as combusting gas temperature and heat transfer coefficient are utilizing the results of 1-D engine simulation software (Ricardo WAVE). The current approach is that the heat transfer coefficients of valve while opening are calculated by considering the intake and exhaust stroke using FLUENT to overcome the difficulty of these values that are not modeled in such 1-D software. Finally, the finite element method (FEM) is used for the valve stress calculation.
The results indicate that the temperature, pressure loss and the flow rate of coolant exhausted from the cooling jacket are concurred with those of experimental results. In addition, the distributions of convective heat transfer coefficients of valves are found to have different behavior for five sections of valve defined in this study…

6. Paper No.(JSAE/SAE)	20179028 / 2017-32-0028
7. Paper title	Numerical Modeling of Heat Dissipation inside the Continuously Variable Transmission of a 400cc Scooter
8. Author (Affiliation)	Hui-Hui Huang(Kun Shan University), Chien-Hsiung Tsai, We-Da Ho(National Pingtung University of Science and Technology)

9. Abstract

In this study, the temperature of solid/fluid inside a continuously variable transmission (CVT) of a 400 cc scooter is investigated numerically utilizing ANSYS FLUENT. The moving reference frame (MRF) technique with conjugate heat transfer between gases and solid rotation/translation are implemented to carry out the simulation. The emphasis of the present study is put on the effects of CVT housing configuration, belt's thermal conductivity, and the heat dissipated from the crankcase on the thermal-flow-field of CVT.
The numerical results show that the temperature of the drive/driven pulleys are concurred with those of experimental results. It is found that the proposed design of partition plate inside the CVT housing can direct the flow into belt and prevent the fluid around driven and drive pulley from mixing, and can further decrease the temperatures of the belt and pulley. The increase of thermal conductivity of belt will increase the average temperature of belt but minimize the temperature difference on it. In addition, the temperature of driven pulley will decrease when belt transition from high ratio to low ratio due to the increase of its rotational speed. The heat dissipation from the crankcase to CVT housing is also explored that the ribs in the housing adjacent to the crankcase served as the fin to enhance the heat transfer from engine to CVT housing…

6. Paper No.(JSAE/SAE)	20179097 / 2017-32-0097
7. Paper title	Modeling of Unsteady Heat Transfer Phenomena at the Intake Manifold of a Diesel Engine and its Application to 1-D Engine Simulation
8. Author (Affiliation)	Emir Yilmaz, Hayao Joji, Mitsuhisa Ichiyanagi, Takashi Suzuki(Sophia University)

9. Abstract

In the past two decades, internal combustion engines have been required to improve their thermal efficiency in order to limit hazardous gas emissions. For further improvement of the thermal efficiency, it is required to predict the mass of intake air into cylinders in order to control the auto-ignition timing for CI engines. For an accurate prediction of intake air mass, it is necessary to model the heat transfer phenomena at the intake manifold. From this intention, an empirical equation was developed based on Colburn equation. Two new arguments were presented in the derived formula. The first argument was the addition of Graetz number, where it characterized the entrance region thermal boundary layer development and its effect on the heat transfer inside the intake manifold. As the second argument, Strouhal number was included in order to represent intake valve effect on heat transfer. This study compared experimental data with the present empirical equation, and average error was estimated to be 3.1%, which was significantly improved in comparison with the Colburn equation. Furthermore, derived empirical heat transfer equation was implemented to the intake manifold model of a diesel engine in 1-D engine simulation. The study confirmed the influence of the heat transfer phenomena, and its importance to intake air. At IVC, temperature difference between Colburn equation and derived equation was calculated to be 3.8 K…

1. Date	November 16th Thursday
2. Room.	D (Nuri 1)
3. Time	15:00 – 16:30
4. Session	Measurement & Simulation III
5. Chair (Affiliation), Co-chair (Affiliation)	Michihisa Nakagawa (Kawasaki Heavy Industries, Ltd.) Adrian Irimescu (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179047 / 2017-32-0047
7. Paper title	Indirect Time-Resolved Visualization of Propagating Flame on Methane-Oxygen Mixture by Densely Installed Multiple Ion-Probes
8. Author (Affiliation)	Tomoaki Yatsufusa, Keigo Kii, Kentaro Takatani, Shinsuke Miyata(Hiroshima Institute of Technology)

9. Abstract

Multiple ion-probes method has an advantage for detailed measurement on high-intensity combustion including engine combustion, oscillation combustion in gas turbine or burner. Multiple ion-probes are installed individually on the surface of the confinement wall in combustion chamber. Detailed behavior of the flame propagation along the chamber wall can be reproduced by the datasets of the flame arrival time detected by individual ion-probes. Main target of this study is to clarify the measurement performance of this multiple ionprobes method for various type of propagating flames generated in confined combustion tube. The characteristics of the flame is largely varied by changing the ratio of dilution with nitrogen on methane-oxygen stoichiometric mixture. No dilution, which means methane-oxygen stoichiometric mixture only, results fastest speed and relatively stable propagation. On the other hand, heavier dilution, which is diluted by larger amount of nitrogen, results lower speed and tabulated propagation. Heavily diluted condition results the propagating flame with lower propagating speed and heavily bent flame front. In addition, propagation velocity was considerably different at each location and each moment. On the other hand, no diluted condition results stable detonation and planner flame front accurately perpendicular to the combustion tube axis was captured. Although measured propagation velocity in 200mm average corresponds to theoretical detonation velocity within 0.5%, fluctuation of 2.4% on velocity was observed in special span of 10mm. This fluctuation seems to be caused by macroexplosion in cell-structure of detonation front…

6. Paper No.(JSAE/SAE)	20179048 / 2017-32-0048
7. Paper title	Precise Measurement of Propagating Flame in 2-Stroke Gasoline Engine by Multiple Ion-Probes
8. Author (Affiliation)	Tomoaki Yatsufusa, Kentaro Takatani, Keigo Kii, Shinsuke Miyata (Hiroshima Institute of Technology)

9. Abstract

Multiple ion-probes method provides fine measurement on propagating flame by using multiple ion-probes installed tow-dimensionally on the wall surface of confined chamber. Each ion-probe detects the arrival of propagating flame and the detecting time is recorded. The data set of flame detecting times is able to re-generate the temporary and spatially detailed behavior of flame propagation. Because ion-probe itself generally has physical and thermal strength, multiple ion-probe method is suitable method for detailed measurement of the combustion resulting pulsatile high pressure such as in reciprocating piston engines.
In the present study, flame measurement technic by multiple ion-probes has been experimentally introduced for measuring the combustion in 2-stroke gasoline engine. The present paper reports the detailed results of measurement on propagating flame in the engine. In addition, newly clarified technical issues of this technic is also mentioned. Experimental results shows that this technic is able to capture the flame even in IDLE operation, which usually results weak combustion and very small flame signal. This is realized by high-speed and high-amplification gain by spatially designed amplification circuit. Finally, temporally and spatially resolved flame propagation behavior was re-generated by averaged flame detecting time data in each ion-probe.

6. Paper No.(JSAE/SAE)	20179113 / 2017-32-0113
7. Paper title	Instantaneous Surface Temperature Measurement in Internal Combustion Engine Using Newly Developed Coaxial Type Thin-Film Temperature Sensor
8. Author (Affiliation)	Daijiro Ishii, Hiromi Saito, Yuji Mihara, Yasuo Takagi(Tokyo City University)

9. Abstract

In order to establish standard method to evaluate cooling loss in combustion chamber of internal combustion engines based on measurement of instantaneous heat flux / wall temperature with higher response and accuracy than previously reported coaxial type thin-film temperature sensor by applying thin film fabrication technology based on PVD method (Physical Vapor Deposition method) which improved to realize higher responsiveness than the conventional sensor was developed by the authors, and it was confirmed that the sensor has sufficient durability in conditions in which the hydrogen jet and flame directly contacts surface of the sensor by thin-film material change. The influence of the improvement on the measurement accuracy was verified by numerical analysis including thermoproperty evaluation. In this report, the configuration of measurement system that can measure minute voltage from the sensor with low noise and high response is reported. Furthermore, in addition to the thermoelectromotive force calibration, an instantaneous responsiveness evaluation device (laser calibration device) that can evaluate the responsiveness of instantaneous heat flux of the sensor was developed and evaluated.

1. Date	November 16 th Tuesday
2. Room.	E (Kakatua)
3. Time	13:00-14:00
4. Session	Two Stroke Engine I
5. Chair (Affiliation), Co-chair (Affiliation)	Tomoo Shiozaki (Honda R&D Co., Ltd.) Pierre Duret (IFP School)

6. Paper No.(JSAE/SAE)	20179037 / 2017-32-0037
7. Paper title	Analysis of SI and HCCI Combustion in a Two-Stroke Opposed-Piston Free-Piston Engine
8. Author (Affiliation)	Stephan Schneider, Horst Friedrich (German Aerospace Center (DLR)), Marco Chiodi, Michael Bargende (Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS))

9. Abstract

The German Aerospace Center (DLR) is developing a free-piston engine as an innovative internal combustion engine for the generation of electrical power. The arrangement of the Free Piston Linear Generator (FPLG) in opposed-piston design consists of two piston units oscillating freely, thereby alternately compressing the common combustion chamber in the center of the unit and gas springs on either side. Linear alternators convert the kinetic energy of the moving pistons into electric energy. Since the pistons are not mechanically coupled to a crank train, the bottom and top dead centers of the piston movement can be varied during operation e.g. to adjust the compression ratio. Utilizing these degrees of freedom, the present paper deals with the analysis of different combustion processes in a port scavenged opposed-piston combustion chamber prototype. This contains the experimental investigation of spark ignition (SI) as well as the transition to homogeneous charge compression ignition (HCCI). Based on test bench results, a 3D-CFD model, which has been used to develop the first prototype, is calibrated by actual measurements. The simulation results enable a deeper analysis of scavenging and in-cylinder processes exceeding the measurement possibilities on a test bench.

6. Paper No.(JSAE/SAE)	20179043 / 2017-32-0043
7. Paper title	Practicability and Influencing Factors of a Lean Burn Mode for Two-Stroke Engines in Hand-Held Powertools
8. Author (Affiliation)	Pascal Piecha, Christoph Ninaus, Stephan Schmidt, Roland Kirchberger (Graz University of Technology), Florian Schumann, Tim Gegg (Andreas Stihl AG & Co KG)

9. Abstract

For many applications, such as scooters, hand-held power tools and many off-road vehicles, two-stroke engines are used as a preferred propulsion unit. These engines convince by a good power to weight ratio, a high durability and low maintenance technology and are therefore the first choice in this field of application. In general, already much development effort has been expended to improve those systems. However, an increasing environmental awareness, the protection of health and the shortage of fossil resources are the driving factors to further enhance the internal combustion process of those adapted two-stroke engines. The current focus here is on the reduction of emissions and fuel consumption with an at least constant power output.

1. Date	November 16 th Tuesday
2. Room.	E (Kakatua)
3. Time	15:00 - 16:00
4. Session	Two Stroke Engine II
5. Chair (Affiliation), Co-chair (Affiliation)	Tomoo Shiozaki (Honda R&D Co., Ltd.) Roland Kirchberger (Graz University of Technology)

6. Paper No.(JSAE/SAE)	20179121 / 2017-32-0121
7. Paper title	Development through simulation of a Turbocharged 2-Stroke G.D.I. Engine Focused on a Range-Extender Application
8. Author (Affiliation)	P. Nuccio, D. De Donno, A. Magno (Energy Department, Politecnico di Torino)

9. Abstract

An original 2-stroke prototype engine, equipped with an electronically controlled gasoline direct-injection apparatus, has been tested over the last few years, and the performances of these tests have been compared with those obtained using a commercial crankcase-scavenged 2-stroke engine. Very satisfactory results have been obtained, as far as fuel consumption and unburned hydrocarbons in the exhaust gas are concerned. Large reductions in fuel consumption and in unburned hydrocarbons have been made possible, because the injection timing causes all the injected gasoline to remain in the combustion chamber, and thus to take part in the combustion process. Moreover, a force-feed lubrication system, like those usually exploited in mass-produced 4-stroke engines, has been employed, because of the presence of an external pump. In fact, it is no longer necessary to add oil to the gasoline in the engine, as the gasoline does not pass through the crankcase volume. The aim of this paper is to present the main features of a new 2-stroke engine, which mainly pertain to the adoption of a turbo compressor for the scavenging and supercharging processes, as well as a small volumetric impeller for the start transitory. Because of its limited size, weight and high specific power output, this engine should be of particular interest for range extender applications in electric vehicles. A numerical simulation has been carried out, to confirm results of the experimental phase, by means of a one-dimensional model that has furnished encouraging results.

6. Paper No.(JSAE/SAE)	20179082 / 2017-32-0082
7. Paper title	Potential of a Production DI Two-Stroke Engine Adapted for Range Extender and Motorcycle Applications
8. Author (Affiliation)	Pierre Duret (IFP School), Stéphane Venturi, Antonio Sciarretta (IFP Energies Nouvelles), Nigel Foxhall, Walter Hinterberger (BRP-Rotax)

9. Abstract

The main purpose of this paper will be to investigate if a small snowmobile gasoline Direct Injected (DI) two-stroke engine has the potential to be adapted for two other types of applications: as a range extender (REX) for electric vehicles and for a motorcycle application.
For the REX application, the main requested specifications (NVH, lightweight, compactness, minimum production cost and easy maintenance), correspond well to the main features of DI 2-stroke engines. The potential of a modified production engine operating in part load ultra-low NOx Controlled Auto Ignition (CAI) to meet the Euro 6 emissions standards on the NEDC cycle has already been demonstrated in a previous paper. In the first part of this new paper, we will investigate which solutions can be used to maintain this potential with even stricter legislations based on Euro 6d, WLTP cycle and Real Driving Emissions (RDE).
In the second part of this paper, the feasibility of using the same production DI 2-stroke base engine for a motorcycle application will be studied. To meet the future Euro 4 and 5 motorcycle emissions standards on the new WMTC driving cycle, new combustion strategies have to be implemented. They are based on the use of CAI at part load and of the control of the air-fuel ratio at higher load combined with a 3-way catalyst aftertreatment technology.
The encouraging results achieved show that such small DI 2-stroke engine could be a very attractive candidate for a low emissions motorcycle application as well as for a range extender application in an electric vehicle.

1. Date	November 17th Friday
2. Room.	A (Merak 1)
3. Time	8:00-9:30
4. Session	Advanced Combustion III
5. Chair (Affiliation), Co-chair (Affiliation)	Koji Yoshida (Nihon University) Simona Silvia Merola (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179069 / 2017-32-0069
7. Paper title	A Study of Ignition and Combustion in an SI Engine using Multistage Pulse Discharge Ignition
8. Author (Affiliation)	Takuma Furusyo, Kotaro Takeda, Yuki Yoshida, Zhimin Lin, Akira iijima, Hideo Shoji(Nihon University), Taichiro Tamida, Takashi Hashimoto(Mitsubishi Electric Corporatio)

9. Abstract

Lean-burn technology is regarded as one effective way to increase the efficiency of internal combustion engines. However, stable ignition is difficult to ensure with a lean mixture. It is expected that this issue can be resolved by improving ignition performance as a result of increasing the amount of energy discharged into the gaseous mixture at the time of ignition. There are limits, however, to how high ignition energy can be increased from the standpoints of spark plug durability, energy consumption and other considerations. Therefore, the authors have focused on a multistage pulse discharge (MSPD) ignition system that performs low-energy ignition multiple times. In this study, a comparison was made of ignition performance between MSPD ignition and conventional spark ignition (SI). A high-speed camera was used to obtain visualized images of ignition in the cylinder and a pressure sensor was used to measure pressure histories in the combustion chamber. The results revealed that MSPD ignition formed a stronger flame kernel than conventional SI under conditions inconducive to flame kernel formation. This was found to be effective in promoting stable combustion.

6. Paper No.(JSAE/SAE)	20179111 / 2017-32-0111
7. Paper title	Effects of Spark Discharge Characteristic on Cycle-to-cycle Variations of Combustion for Lean SI Operation with High Tumble Flow
8. Author (Affiliation)	Kosaku Sasaki, Dongwon Jung, Takeshi Yokomori, Norimasa Iida (Keio University)

9. Abstract

It has been shown that lean burn is effective for improving the thermal efficiency of gasoline SI engines. This happens because the reduction of heat loss by decrease of flame temperature. On the other hand, the fuel dilution of the premixed gas makes the combustion speed low, and cycle-to-cycle variations of combustion are increased by excessive dilution, it is difficult to increase the thermal efficiency of the gasoline SI engine. Influence of ignition by spark discharge is considered as a factor of combustion variation, and it is necessary to understand the effects of spark discharge characteristics on the lean combustion process. Spark discharge in the SI engines supplies energy to the premixed-gas via a discharge channel in the spark plug gap which ignites the premixed-gas. The discharge channel is elongated by in-cylinder gas flow and its behavior varies in each cycles. When the discharge channel is elongated, the premixed-gas on the discharge channel increases and the gap resistance increases. As a result, the pattern of the discharge energy supply to the premixed gas by the spark discharge also changes in each cycle. It may affect the lean-burn combustion process. However, the relationship between spark discharge and combustion has not been clarified.

In this study, using an ignition system with 10 ignition coils and an adapter for intensify the tumble flow, we photograph the behavior of the discharge channel with a visualization engine. The relationship between discharge channel length and gap resistance are clarified. Then combustion experiments were carried out, discharge current, discharge voltage and in-cylinder gas pressure were measured at the same time. We investigated the influence of gap resistance on the combustion phase

As a result, there was a correlation between the discharge channel area and the gap resistance. It is possible to estimate the spark discharge channel area from the gap resistance, by measuring the discharge voltage and the discharge current without using the visualization device. When the average gap resistance was more than 45 kΩ, CA 5 became 0 deg.ATDC or less except for 1 cycle. Therefore, it was revealed that combustion was promoted when the discharge channel was stretched and the gap resistance was large.

1. Date	November 17th Friday
2. Room.	A (Merak 1)
3. Time	10:00-11:30
4. Session	Advanced Combustion IV
5. Chair (Affiliation), Co-chair (Affiliation)	Koji Yoshida (Nihon University) Simona Silvia Merola (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179064 / 2017-32-0064
7. Paper title	Fuel Economy Development for a CVT Powertrain on Roller-Chassis Dynamometer and Transfer to Dynamic Engine Testbed
8. Author (Affiliation)	Christian Hubmann, Harald Mayrhofer, Hubert Friedl , Gerald Hochmann(AVL List GmbH)

9. Abstract

The motorcycle and small engine industry is entering a chapter where emission legislation (EU5, BS6) is adapted to the automotive industries and especially CO2 emission is coming more and more into the focus of the OEMs, the legislative authorities and finally the end-user. Technologies like variable valve actuation, direct gasoline injection and turbo charging are state of the art in the automotive industry and have brought the efficiency of the internal combustion engine onto the next level. Nevertheless the small engine manufacturers are seeking for solutions which are cost efficient as well as simple and easy to apply. Even powertrain complexity is increasing the development efforts have to be kept moderate. Therefore, there is strong request for modern instrumentation and Testbeds which support an efficient and effective development process.

This paper describes the development on an 110cc scooter engine with the main focus on fuel consumption reduction during the hardware development on the engine Testbed as well as chassis dyno . Furthermore, it has been investigated how the efficiency, robustness and reproducibility of the development process and its test environments can be increased by using an advanced dynamic engine Testbed. This innovative Testbed is combined with a belt drive transmission which allows to operate as stationary single cylinder engine, as well as in power pack- (i.e. internal combustion engine including transmission) configuration under steady-state or dynamic operating mode.

6. Paper No.(JSAE/SAE)	20179077 / 2017-32-0077
7. Paper title	Group Combustion Excitation in Randomly Distributed Droplet Clouds Based on Flame-spread Characteristics with Two-droplet Interaction in Microgravity
8. Author (Affiliation)	Herman Saputro, Laila Fitriana (Sebelas Maret University)

9. Abstract

Experiments of flame-spread of fuel droplets have been performed in microgravity actively. However, the experiment has limitation in the number of droplets due to relatively short microgravity durations in the ground based facilities. It is difficult to conduct flame spread experiments of large scale droplet clouds in microgravity. This study conducted simulation of flame-spread behavior in randomly distributed large-scale droplet clouds by using a percolation approach, in order to make a theoretical link the gap between droplet combustion experiments and spray combustion phenomenon with considering two-droplet interaction. Droplets are arranged at lattice points in 2D lattice. The occurrence probability of group combustion (OPGC) is calculated as a function of the mean droplet spacing (S/d0)m. The (S/d0)m for 0.5 OPGC is defined as the critical mean droplet spacing (S/d0)critical, which separates the droplet cloud into two groups if the lattice size becomes infinity; relatively dense droplet clouds in which the group combustion is excited through flame spread and dilute droplet clouds in which the group combustion in is never excited. The results show that in 2D droplet arrangements, the (S/d0)critical considering two-droplet interaction is higher than that without considering two-droplets interaction.

1. Date	November 17 th Friday
2. Room.	B (Merak 2)
3. Time	8:00 - 9:30
4. Session	Alternative Fuels III
5. Chair (Affiliation), Co-chair (Affiliation)	Toru Nakazono (LEMA / YANMAR Co., Ltd.), Iman K. Reksowardojo (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20159103 / 2015-32-0103
7. Paper title	Development of a fuel injection strategy for a Diesel engine Fumigated with Ethanol
8. Author (Affiliation)	Tripoom – Painrungrot, Chinda Charoenphonphanich (King Mongkut's Institute of Technology Ladkrabang.) Hidenori Kosaka(Tokyo Institute of Technolgy) Manida Tongroon(National Metal and Materials Technology Center)

9. Abstract

Diesel engine are widely use all over the world. Because they can generate high torque even in low speed operation, and they give more efficiency from the fuel input compare to gasoline engine. But diesel engine still releases lots of emission which are harmful to environment. So, many researchers are going to improve the efficiency and reduce the emission from the combustion process. Ethanol is a good choice for alternative fuel which is prefer to dual fuel diesel engine. Because ethanol made from plant such as sugar cane, cassava, sorghum, and so on, which can reduce CO2 in photosynthesis process. In this study, ethanol will be injected in to the intake manifold to cool down the intake temperature and reduce the amount of diesel fuel consumption. However, there are many parameters that effect to the combustion. Injection timing, injection pressure, and injection amount are some of essential factor that gives different result. This study also uses a technique call internal exhaust gas recirculation. The exhaust valve will be reopened during the intake stroke to vaporize the injected ethanol in the combustion chamber.
The objective of this research is to study the effect of injection timing of dual fuel (diesel and ethanol) on the engine performance and exhaust emissions of a supercharged, single cylinder 4-stroke direct injection compression ignition engine including ethanol fumigation and internal EGR. By varying the diesel injection timing from the original position by 4 degree more and less from -10o ATDC, and also varying the injection pressure of 80, 100, 120 MPa. Then using ethanol fuel as a secondary fuel to replace the energy input from diesel fuel by 10, 20, and 30%. The engine speed will be fixed at 1000 rpm. The injection timing of ethanol is 400o ATDC and the injection pressure is 2 MPa.

6. Paper No.(JSAE/SAE)	20179088/ 2015-32-0749
7. Paper title	An Effect of Bio Diesel Fuel for Low Compression Ratio Diesel Engine Performance
8. Author (Affiliation)	Hikaru Yamada, Koji Yoshida(Nihon University)

9. Abstract

The purpose of this study is to explore an effect of the coconut oil methyl eater (CME) and vegetable oil methyl ester (VME) on a low compression ratio diesel engine performance. The CME and VME were produced from coconut oil and vegetable oil which was made from soybean oil and rapeseed oil, respectively. The coconut and vegetable oils were transformed into the methyl eater by the esterification process and the sodium hydroxide was used as catalyst. The test engine was an air cooled four-stroke single cylinder direct injection small diesel engine with a mechanical fuel injection system. The compression ratios was changed to vary the clearance volume by putting the brass plate between cylinder head and cylinder block and compression ratios of 21.2, 19.3, 18.0, and 17.3 were attempted. Here, the ordinary compression ratio of test engine was 21.2. The engine performance and exhaust gas emissions were measured in the steady operation condition at engine speed of 3600 rpm and the brake mean effective pressure was varied from 100 kPa to maximum at every 100 kPa. The ignition timings of CME and VME were advanced and the maximum cylinder pressures of CME and VME were higher as compared with the diesel fuel in case of low compression ratios, because CME and VME consisted of medium chain fatty acid methyl eaters. However, the COV of maximum cylinder pressure and the COV of indicated mean effective pressure of both CME and VME were almost the same as the diesel fuel when the brake mean effective pressure was more than 200 kPa. This is because the combustion was stabilized at the middle load and high load operation. The brake thermal efficiency of diesel fuel was slightly higher than those of CME and VME for any compression ratios. THC and CO concentrations of CME and VME were lower than those of diesel fuel in case of low compression ratio, because CME and VME were oxygenate fuel. THC and CO concentrations of CME were lower than those of VME because the mass fraction of oxygen in CME was higher than VME. The smoke concentration showed very higher value in any of fuel at the engine high load. This is because amount of fuel injection increased as increasing with the engine load. CME could not reduce the smoke concentration in high load even though CME contained 14.7 wt.% of oxygen atoms. NOx concentration of CME was lower than that of diesel fuel for any compression ratios in the high load operation, because the maximum rate of heat release of CME was lower than diesel fuel due to the superior ignition feature of CME. The CO2 and SO2 concentrations in any of fuel were almost the same at any operating conditions. Therefore, CME and VME were adaptable as alternative fuel for the low compression ratio diesel engine, because ignition characteristics of CME and VME were improved in case of low compression ratio.

1. Date	November 17 th Friday
2. Room.	B (Merak 2)
3. Time	10:00 - 11:30
4. Session	Lubricants
5. Chair (Affiliation), Co-chair (Affiliation)	Toru Nakazono (LEMA / YANMAR Co., Ltd.) Mike Marcella (Maxima Racing Oils)

6. Paper No.(JSAE/SAE)	Organized speech
7. Paper title	Durability of Multi Grade Motor Cycle Engine Oil
8. Author (Affiliation)	Mia Krishna, Fathona Shorea, Nabila(Pertamina Lubricants)

9. Abstract

Motorcycle population in Indonesia hits more than 126 million units in 2017. Align with the situation, concern on motorcycle emission and fuel economy is growing and this contributing to the trend of thinner and multi grade engine oil application.

With such application, the role of engine oil durability becomes more important. This study is held to understand the durability of engine oil and whether the current properties in the quality standard are able to differentiate the durability of available motorcycle engine oil in the market.

6. Paper No.(JSAE/SAE)	20179008/ 2017-32-0008
7. Paper title	Delivering Fuel Economy with Motorcycle Oil Additive Technology
8. Author (Affiliation)	Pei Yi Lim ,Youhei Inagaki (Infineum Singapore Pte Ltd)

9. Abstract

Sustainability trends and reduced fuel consumption as a value proposition to end users have led to ever-increasing focus on fuel efficiency in the personal mobility segment. This is evident in the development of smaller and lighter engine hardware with optimized combustion systems as well as the lowering of engine oil viscosity grades and formulation of additives with improved friction properties. Due to the unique challenges of lubricating motorcycle engines, the development of fuel efficient motorcycle engine oil presents several technical dilemmas. The reduction of oil viscosity gives rise to durability concerns particularly in such high temperature and high speed operating conditions, while the formulation of additives with lower friction properties may affect clutch friction that is necessary for a manual motorcycle. Hence, this study was embarked on to develop a 4T motorcycle engine oil formulation that can achieve fuel economy credits without compromising clutch friction and durability.

The development began with a fundamental understanding of the surface and viscometric effects from each major component of the formulation (including within the additive system, the basestocks and the formulation viscometrics) and across each lubrication regime (i.e. from the boundary to hydrodynamic regime). This was followed by the optimization of these components to maximize fuel economy credits. Finally, a prototype was developed through a balanced combination of these components to provide a well-rounded friction reduction across the entire lubrication regime, as benchmarked against an SAE 10W-30 OEM Genuine Oil. The preliminary friction screening tools used in this study were bench tests (i.e. SRV, HFRR and MTM) run under carefully selected test conditions, with the fuel economy data subsequently validated through a chassis dynamometer test based on the World Motorcycle Test Cycle in an actual motorcycle. In addition, to assess the hypothesis that engine friction can be reduced without compromising clutch friction and durability, the prototype was put through the JASO T903:2016 and modified FZG gear pitting tests. The results of this extensive fundamental understanding and performance evaluation activity will be presented in detail in this paper.

6. Paper No.(JSAE/SAE)	20179095 / 2017-32-0095
7. Paper title	Effect of Biofuel and Soot on Metal Wear Characteristic using Electron Microscopy and 3D Image Processing
8. Author (Affiliation)	Preechar Karin, Warawut Amornprapa, Phiranat Khamsrisuk, Pol-ake Budsayahem , Pattara Chammana (King Mongkut's Institute of Technology Ladkrabang) Katsunori Hanamura(Tokyo Institute of Technology) Kobsak Sriprapha(National Electronics and Computer Technology Center)

9. Abstract

The characteristics of soot affecting on engine oil degradation and metal wear would be studied. Soot particle contamination in engine oil was simulated using pure carbon black. Micro-nanostructure of soot particles were studied by Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Laser diffraction spectroscopy (LDS). The metal wear behavior was studied by means of a Four-Ball tribology test with wear measured. Wear roughness in micro-scale was also investigated by high resolution Optical microscopy (OM), 3D rendering optical technique and SEM image processing method. Moreover, the impact of biofuel on engine oil degradation and metal wear was also reported.

1. Date	November 17 th Friday
2. Room.	C (Merak 3)
3. Time	08:00 - 9 :30
4. Session	Emissions&Environmental Impact III
5. Chair (Affiliation), co-chair (Affiliation)	Hiromi Deguchi (SUZUKI MOTOR CORPORATION), Kai Beck (STIHL)

6. Paper No.(JSAE/SAE)	20179076 / 2017-32-0076
7. Paper title	Motorcycle Emission Profiles in Bandung City, Indonesia
8. Author (Affiliation)	Adyati P Yudison, Driejana Driejana, Iman K Reksowardojo, Aminudin Sulaeman (Institut Teknologi Bandung)

9. Abstract

Motorcycles account for almost 80% of private vehicle in Indonesia, with annual growth rate of 12%/year. This paper aims to investigate the emission profiles of CO2, CO, HC and NOx based on typical fuel and motorcycle types in Indonesia. Questionnaire survey was undertaken to gather fuel type, engine technology and capacity that represent motorcycle population in Bandung City, Indonesia. Emissions were measured based on 6 speed variations on chassis dynamometer. Questionnaire survey from 290 respondent shows that Euro II and Euro III technology with engine capacity less than 150 is the most utilized type of motorcycle in Bandung. Most of user choose RON 90 and RON 92 gasoline. Based on the results, 4 group of 5 motorcycle of EIIRON90, EIIRON92, EIIIRON90, and EIIIRON92 were tested. Emission data shows that the higher the speed the lower the emission, except for CO and NOx which have different pattern. …..

6.Paper No.(JSAE/SAE)	20739094 / 2017-32-0094
7. Paper title	Impact of Biodiesel on Small CI Engine Combustion Behavior and Particle Emission Characteristic
8. Author (Affiliation)	Preechar Karin, Chinda Charoenphonphanich, Jiramed Boonsakda, Park Watanawongskorn, Eakkawut Saenkhumvong, Settavit Sirivarocha, Sippakorn Rungsritanapaisan(King Mongkut's Institute of Technology Ladkrabang) Nuwong Chollacoop(National Science and Technology Development Agency), Katsunori Hanamura(Tokyo Institute of Technology)

9. Abstract

A diesel engine is a high thermal efficiency and durability. However, in-use diesel engines produce high concentration of particulate matter (PM). PM must be removed from the exhaust gas to protect human health. This research describes biodiesel engine performance, efficiency and combustion behavior using combustion pressure analyzer. Moreover, PM emitted from CI engines can be reduced by using renewable bio-oxygenated fuels. The particle size and quantity of biofuel are smaller than that of fossil diesel. Nanostructure and aggregation behavior should be investigated for better understanding. The nanostructures and morphology of fossil fuel and biofuel PMs would be investigated by using a Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Laser diffraction spectroscopy (LDS).

6. Paper No.(JSAE/SAE)	20179126 / 2017-32-0126
7. Paper title	A Visualization Study of Soot Production and Oxidation Characteristics Under Diesel Engine Like Conditions
8. Author (Affiliation)	Huynh Thanh Cong, Cong Thanh Huynh (Ho Chi Minh City University of Technology), Akihiko Azetsu, Takahiro Kashima, Daisuke Komasaki, Yuta Saito (Tokai University)

9. Abstract

To explore the production and oxidation characteristics of soot in the flame of diesel jet under the condition equivalent to the direct injection diesel engine condition, the effect of three different important parameters (including injection pressure, injection duration, and oxygen concentration) are experimentally examined. For these purposes, a small CVCC (constant volume combustion chamber) with the volume of 60cc equivalent to the volume of combustion chamber of automotive diesel engine is used.
To obtain the experimental data of soot production and oxidation, in experiments, the ambient condition of temperature, pressure and oxygen concentration before injection timing are prepared by the combustion of lean hydrogen mixture (with help of 8 spark plugs) at a high temperature and pressure condition around 1000K and 4.5MPa. The common rail type injector with 8 injection holes for modern diesel engine is attached to this vessel. Injection pressures are set up at 80, 100, and 120 MPa. The effects of three important factors are analyzed including: (1) different injection pressures with constant injection mass; (2) different injection pressures with constant injection duration; (3) oxygen concentrations of 21% and 17% in volume. …..

1. Date	November 17 th Friday
2. Room.	C (Merak 3)
3. Time	10:00 – 11:30
4. Session	Vehicle Components
5. Chair (Affiliation), Co-chair (Affiliation)	Hisayuki Sugita (SUZUKI MOTOR CORPORATION), Ignatius P. Nurprasetio (Institut Teknologi Bandung)

6. Paper No.(JSAE/SAE)	20179049 / 2017-32-0049
7. Paper title	Development of Titanium Fuel Tank Applied for Mass-production Motocrossers
8. Author (Affiliation)	Kohei Hirano, Yuki Chihara (Honda R&D Co., Ltd.)

9. Abstract

The new titanium fuel tank has been developed to reduce weight of the fuel tank of production motocrossers. While the titanium permits deep drawing to shape a tank by presswork, the processing of titanium material is difficult, hence no past application of the material for a motorcycle fuel tank. This project was aimed at development of new techniques for mass production of titanium fuel tanks, and succeeded in mass production of titanium fuel tanks having an adequate durability to apply to a motocrosser that can receive a strong impact while driving. As a result, approximately 40% of weight reduction from the plastic fuel tank having the same fuel capacity was realized.

6. Paper No.(JSAE/SAE)	20179123 / 2017-32-0123
7. Paper title	Design of Motorcycle Front Fork for Impact Loads
8. Author (Affiliation)	Girish Kokane, Dinesh Kalani, Ravindra Kharul, Muragendra Magdum (Endurance Technologies Ltd.)

9. Abstract

With advancements in powertrain technologies & light weighting of vehicle structures, the average driving speeds of motorcycles are increasing. This makes it important to safeguard the vehicle structure from possible impact loads or crash events. The front suspension of a motorcycle typically consists of telescopic front fork which acts as a structural member as well. Thus modern vehicle front forks should be designed keeping in mind frontal impacts as well. Which means the structural stiffness of front fork needs to be optimally designed so that during impacts, the structure should deflect absorbing the bulk of the impact energy safeguarding the rest of the vehicle structure including chassis. At the same time the front fork should not break.

The popular design improvement techniques like increasing section modulus, heat treatments to increase strength may or may not have positive effect on impact strength. Even some of the finite element analysis techniques like linear and/or static analysis would not be able to simulate the impact dynamics. The impact testing would not be always feasible during new product development.

This paper focusses on a virtual simulation methodology for predicting the behavior of front fork under impact loads. Various design aspects, critical to impact performance are identified. An exhaustive impact testing is done for multiple design configurations. It is well known that the failure mechanism under impact events is different from the conventional failure modes & the impact simulation methodology successfully captures it well. Further based on the simulation, design philosophy & guidelines are arrived at to ensure design adequacy under impact loads.

1. Date	November 17th Friday
2. Room.	D (Nuri 1)
3. Time	8:00 - 9 :30
4. Session	Measurement & Simulation IV
5. Chair (Affiliation), co-chair (Affiliation)	Tadao Okazaki (Kubota Corporation), Adrian Irimescu (Istituto Motori-CNR)

6. Paper No.(JSAE/SAE)	20179071 / 2017-32-0071
7. Paper title	Simulation based optimization of a motorcycle drivetrain by the integration of a novel continuously variable planetary transmission
8. Author (Affiliation)	Juergen Tromayer, Michael Gaber (Graz University of Technology), Scott McBroom, Fern Thomassy (Fallbrook Technologies Inc.)

9. Abstract

Drive trains of motorcycles, especially on small low-cost vehicles for daily use can contribute quite a lot to the overall fuel economy as well as the emission output. Meeting upcoming emission limits such as EURO 5 with comparatively simple and low-cost vehicles will be very challenging. On the engine side, a big effort in terms of fuelling, combustion optimization as well as exhaust gas aftertreatment will be necessary without any doubt. Even complex systems that enable variabilities in valve timing might become more and more important. Besides those big technological steps in development of small capacity engines for the mass markets, the additional system optimization potential that can be gained by a systematic adaption of the drive train is more than noteworthy. Hence, a detailed study to derive this potential was carried out by means of a longitudinal dynamics simulation in Matlab-Simulink□

6.Paper No.(JSAE/SAE)	20179074 / 2017-32-0074
7. Paper title	Comparison of Optimal & Real-time Operation Strategy for a Hybrid Electric Motorcycle
8. Author (Affiliation)	Paul Rieger, Bernhard Schweighofer, Hannes Wegleiter, Christian Zinner, Stephan Schmidt, Roland Kirchberger (Graz University of Technology) Nigel Foxhall, Walter Hinterberger (BRP-Powertrain GmbH & Co KG)

9. Abstract

Within the motorcycle- and powersport sector the hybridization and electrification of the powertrain is increasingly becoming an important topic. In the automotive sector the hybridization of the powertrain is already well established and shows improvements regarding fuel consumption and emission behavior. Also in the motorcycle sector the emission legislation limits are getting stricter and the requirement for a significant reduction of fuel consumption, especially under real drive condition, is being focused. Furthermore, the increasing environmental awareness of the customer requires measures regarding fuel consumption- and emission minimization. Due to the high system complexity and degrees of freedom of hybrid powertrains, the simulation of the complete vehicle is essential for the component dimensioning, concept selection and the development of operation strategies. Generally, two approaches of complete vehicle simulations can be differed□

6. Paper No.(JSAE/SAE)	20179038 / 2017-32-0038
7. Paper title	A Model Based Approach for Generating Pre-Calibration Data for Two-Wheelers
8. Author (Affiliation)	Rose Mary Simon Palackal, Karthikeyan Ramachandran (Robert Bosch Engineering And Business Solns Pvt Ltd), Balagovind Nandakumar Kartha, Pramod Reddemreddy (Bosch Limited) Srikanth Vijaykumar (Robert Bosch LLC)

9. Abstract

Today, 99% of the two wheelers in India operate with carburetor based fuel delivery system. But with implementation of Bharath Stage VI emission norms, compliance to emission limits along with monitoring of components in the system that contributes towards tail pipe emissions would be challenging. With the introduction of the OBD II (On-Board Diagnostics) and emission durability, mass migration to electronically controlled fuel delivery system is very much expected. The new emission norms also call for precise metering of the injected fuel and therefore demands extended calibration effort.
The calibration of engine management system starts with the generation of pre-calibration dataset capable of operating the engine at all operating points followed by base calibration of the main parameters such as air charge estimation, fuel injection quantity, injection timing and ignition angles relative to the piston position.

1. Date	November 17 th Friday
2. Room.	D (Nuri 1)
3. Time	10:00 - 11 :30
4. Session	Engine Controls
5. Chair (Affiliation), co-chair (Affiliation)	Yutaka Nitta (SUZUKI MOTOR CORPORATION), Ken Fosaaen (Kerdea Technologies)

6. Paper No.(JSAE/SAE)	20179045 / 2017-32-9045
7. Paper title	Development of Motorcycle Engine Starting System Simulation Considering Air-Fuel Ratio Control
8. Author (Affiliation)	Yoshihito Itou, Daiki Itou, Minoru Iida (Yamaha Motor Co., Ltd.)

9. Abstract

Recently the response of the engine speed at starting has more importance than ever for quick start satisfying rider□s needs, as well as exhaust emissions. We have developed a simulation for studying engine and starter specifications, engine control algorithm and other engine control parameters. This system can be utilized to realize appropriate starting time by considering air-fuel ratio under various conditions.
This paper addresses what are taken account of in our method. Examples applying this to a conventional motorcycle engine are shown.

6.Paper No.(JSAE/SAE)	20179052 / 2017-32-9052
7. Paper title	Research on Misfire Detection Algorithms for Motorcycle Engine Firing at Uneven Intervals
8. Author (Affiliation)	Katsunori Tasaki (Keihin Corporation)

9. Abstract

Misfire is the condition where the engine does not fire correctly due to an ignition miss or poor combustion of the air fuel mixture, resulting in serious deterioration of tailpipe emissions due to the discharge of unburned gas. In order to prevent further exacerbating environmental problems, misfire detection is obligatory in On Board Diagnosis (OBD) II systems.
OBD II technology for passenger cars cannot be easily adopted to motorcycles for several reasons. However, very little research has been reported on misfire detection for an unevenly firing engine in which the degree of contribution to engine output and the variation pattern of angular velocity show a large difference between cylinders, an aspect that is unique to motorcycles.
This research focuses on uneven firing V-twin motorcycle engines, to explore misfire detection techniques using variation characters in crank angular velocity.

6. Paper No.(JSAE/SAE)	20179065 / 2017-32-9065
7. Paper title	Enhanced Diagnosis for Small Engines
8. Author (Affiliation)	Riccardo Basso, Hans-Jürgen Schacht, Matthias Rath, Markus Neumayer, Stephan Schmidt, Roland Kirchberger (Graz University of Technology), Christian Reisenberger (BRP-Powertrain GmbH & Co KG)

9. Abstract

Small engines for non-automotive and two wheeler applications have a reduced number of sensors. For fulfilling emission regulations a cost effective way is an enhanced use of standard sensors in order to obtain more information from the existing sensors. The delivered information can then be used for an on-board diagnosis. Moreover, it is important to control the quality of the product during engine production; therefore an end-of-line cold engine test is often made. With this measure it is possible to detect faults, wrong tolerances or assembly in order not to deliver faulty engines to the customers.
In this paper, an enhanced use of sensors for fault detection will be discussed. It is possible to obtain more information from the signal or to use the sensor for detecting other parameters. For extracting information signal analysis methods will be used with focus on the computational power need since the ECU performance is limited. The starter motor current is a useful indicator for detecting a lack of compression in an end-of-line check. Furthermore, it is possible to assign the fault to a specific cylinder by using one single sensor. It has to□

1. Date	November 17th Friday
2. Room.	E (Kakatua)
3. Time	8:00 – 9:30
4. Session	Engine Component　I
5. Chair (Affiliation), Co-chair (Affiliation)	Takahito Murase (Kawasaki Heavy Industries, Ltd.) Tony Sczcotka (Robert Bosch LLC)

6. Paper No.(JSAE/SAE)	20179055 / 2017-32-0055
7. Paper title	Optimization of Intake Port for Improvement of Fuel Consumption and Torque
8. Author (Affiliation)	Yota Sakurai, Yoshinori Nakao, Astushi Hisano, Masahito Saitou , Kunihiro Tanaka (Kawasaki Heavy Industries, Ltd.)

9. Abstract

In this study on the motorcycle engine, we investigated the geometry of the newly developed intake port with an objective of improving the fuel consumption and the torque in practical range. Herein we present the results obtained. We believe that an effective measure for achieving the stated objective is to improve the combustion speed and combustion stability. To realize that, it is necessary to increase the turbulence during combustion and improve the homogeneity of air-fuel mixture. To investigate the feasible shape of the port, the CFD simulation (including fuel spray analysis) was performed and a geometry that improved the turbulent kinetic energy and mixture homogeneity at the time of ignition was selected.

For confirming the combustion improvement effect achieved by tumble strengthening, an engine test was conducted with the same amount of intake air as that used in. Analysis of the heat release rate calculated from the pressure in the cylinder revealed that an improvement in the burning rate and combustion was achieved by adopting the newly developed intake port shape. As a result of the above approach, by improving the turbulent kinetic energy and the homogeneity of the air-fuel mixture, the fuel efficiency has been improved and the torque also improved in the practical range.

6. Paper No.(JSAE/SAE)	20179124 / 2017-32-0124
7. Paper title	VAVE design of Antihop Clutch for Motorbikes.
8. Author (Affiliation)	Ashutosh Padmakar Jahagirdar, Nitin R Bhone, Ashok B Kulkarni, Ravindra Vyankatrao Kharul (Endurance Technologies Ltd.)

9. Abstract

Anti-Hop Clutches are popular for bikes above 400 cc. They offer the advantage of better driving stability in lower gears and during down shifting. The currently used designs of such clutches are having different constructions with complex geometry parts and almost 30% more number of parts (compared to standard clutch) are used in some designs to achieve the desired 'Driving Assist' and 'Coasting Slip' effect. The production process used, demands for specialized tools for manufacturing the complex geometry of parts and the price of the clutch assembly is more than double as compared to standard, equivalent design of multi plate wet clutches. These type of clutches are commonly known as – Anti Hop Clutch or Slipper Clutch or Assist and Slip clutches.

To achieve same performance benefits with simpler design, less number of parts with a Flexibility to alter the Assist and Slip effect to suit the application, Endurance Technologies Ltd. developed a new concept. The simplicity of design and enhanced effect of Assist and Slip is experienced on vehicle trials. Further the design can be optimized to meet the expected performance and durability targets of the intended application.

In this paper the details of concept clutch construction, Mathematical models developed, Performance and durability measurements taken on the vehicle are summarized which is trademarked as Endurance Variable Torque Clutch (EVTC®). The evaluation of different variables on performance is discussed and to achieve the performance within a narrow tolerance band the special design considerations utilized are elaborated. For achieving better ergonomic effect on Clutch lever, the clutch uses a pair of diaphragm spring which is assembled so as to inherently reduce the variations in clutch performance over the life span.

1. Date	November 17 th Friday
2. Room.	E (Kakatua)
3. Time	10 : 00-11 : 30
4. Session	Engine Component II
5. Chair (Affiliation), Co-chair (Affiliation)	Yuji Araki (YAMAHA MOTOR Co., Ltd.), Roland Kirchberger (Graz University of Technology)

6. Paper No.(JSAE/SAE)	20179003 / 2017-32-0003
7. Paper title	Innovative Carburetor Design with Dynamic Air to Fuel Ratio (AFR) Control for Improved Fuel Economy and Reduced Emissions
8. Author (Affiliation)	Timothy C Simmons (INI Power Systems)

9. Abstract

An innovative carburetor system has been developed for use in single cylinder small engines. The carburetor has been implemented on a 79cc 4 stroke portable gasoline generator for the purposes of illustrating its effect in reducing emissions, engine deposits and improving fuel economy without re-jetting the carburetor. This method of carburetion dynamically tunes the venturi effect in the carburetor, allowing for air density, fuel viscosity and fuel type compensation for optimal AFR. Modified and stock generators were tested at various power levels, elevations and temperatures to simulate operational environments. The improvements in emissions and fuel consumption will be presented. In addition, the system has been designed as a bolt-on, low cost alternative to an EFI method of complying with emissions regulations for existing small engine applications.

6. Paper No.(JSAE/SAE)	20179060 / 2017-32-0060
7. Paper title	Study on a Cyclone Air Cleaner with Discharge Function under the Intake Pulsation of a General Purpose Engine
8. Author (Affiliation)	Hiroto Takahashi, Toshiki Shinohara(Honda R&D Co., Ltd.)

9. Abstract

Many general purpose engines, such as the ones used in construction machines, operate in environments with excessive amounts of airborne dust, and are thereby equipped with a cyclone air cleaner so that they can remove as much dust from contaminated air streams in the engine. However, the compact general purpose engine is mainly a single-cylinder type, and the intake flow pulsates. Since the centrifugal action of the cyclone air cleaner under the intake pulsation changes according to the pulsation, it is difficult to enhance the dust separation performance. In this study, we aimed to determine a cyclone air cleaner factor with high purification performance even under the intake pulsation conditions of a general purpose engine. We have designed an ideal geometry for the cyclone air cleaner, which centrifugally separates dust during inhaling and discharges the centrifuged dust using positive pressure due to pulsation. A numerical calculation of the flow under the intake pulsation of this cyclone air cleaner was carried out, and the separation and discharge functions were analyzed. Accordingly, it was confirmed that although the swirling speed inside the cyclone air cleaner depended on pulsation, it demonstrated purification performance even under an intake pulsation by the dust discharge function. We have also found a method to operate the discharge function at the instant when the separation function is the strongest.