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Posters

Kustron P et al., Adv Automob Eng 2016, 5:2(Suppl)
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Application of ultrasonic testing for quality evaluation of Magnetically Impelled Arc But Welded drive shafts of motor vehicles

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The article presents contemporary ultrasonic methods that can be applied to evaluate the quality of transmission drive components of motor vehicles. The issues of non-destructive analysis of discontinuities in manufactured drive shafts, consisting currently of thin-walled tubes, were investigated in this study. The driveshaft elements were joined by using innovative method called Magnetically Impelled Arc But Welding (MIAB). For many years a major challenge for engineers working with ultrasonic techniques was joining of thin-walled components (having thickness below 3 mm). In addition of this limitation, the problem of variable geometry of the weld flash on the weld perimeter was highlighted. To reduce the impact of mentioned factors the pseudo-surface waves (also known as lateral waves) have been applied in this study. For optimal parameters selection of the ultrasonic beam propagation and understanding the physical-acoustic phenomena, the Finite Elements Method modeling was performed also. The phenomena of wave transformation on medium boundary and reflections from artificial flaw have been analyzed. The results of numerical analysis were confirmed by experimental research. Manufactured MIAB welding joints were tested by ultrasonic method with using designed experiment setup. Selected configurations with various shapes, dimensions and process variables have been investigated. The results confirm the usefulness of ultrasonic methods for quality evaluations of butt welds made by MIAB welding parts transmission shafts of motor vehicles.

Biography

Kustron P is an Assistant Professor at Wroclaw University of Science and Technology. He professionally works with welding technology and FEM analysis of welded joints. He is Specialist in the field of destructive and non-destructive tests. He is actively cooperating with automotive industry in modeling and analysis techniques of manufacturing methods.

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Characterization of wear mechanisms occurring on piston ring and cylinder bore of the internal combustion engine

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Wear is the progressive loss of materials from contacting surfaces relative in motion. Different wear mechanisms occur during engine operation. According to the literature survey; especially, wear in the cylinder bore and on the piston ring is caused by abrasion, scuffing (adhesion), corrosion, bore polishing and delamination. One of the most critical tribological areas in an engine is the cylinder-ring interface. Cylinder-ring wear has been known to play a major role in internal combustion engine durability, performance, emissions and fuel economy. Wear in an engine cylinder liner reaches its maximum at the top ring reversal point. Wear at the top dead center (TDC) of the piston ring travel is heavy because of the high contact pressure, the thin lubricant film due to the low sliding velocity and high gas temperature. The aim of this paper is to present wear mechanisms occurred on the surface of diverse piston rings (even coated and uncoated) and cylinder liner sliding pairs which were rubbed under boundary lubricating conditions using reciprocating tribotest machine and single cylinder spark ignition Honda GX 270 test engine for 75 hours using commercial lubricating oil. Accommodating and confirming to literature survey, protective additives layer and different wear mechanisms were identified using micro- and nano-analysis. While additive layers were formed on the rubbed surface of both piston rings and cylinder liner in tribometer tests, they were only detected at the TDC of cylinder liner of engine tests. Any additive protective layers were detected on the piston ring of engine tests.

Biography

Selman Demirtaş is currently pursuing his MSc at Yıldız Technical University, Faculty of Mechanical Engineering, Automotive Division.

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Surface coating of monolayer graphene on piston ring for internal combustion engines

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The study of graphene has been one of the most exciting topics in material science and many other research fields since the first report of the preparation and isolation of single graphene layers in 2004. After the experimental discovery of its unique properties in 2004, graphene has become a material of intense research with a variety of applications in electronics, photonics and sensor technologies. For most of these applications, large area monolayer and bilayer graphene films are used. The growth of graphene by Chemical Vapor Deposition (CVD) on polycrystalline copper foils has become very popular because of its scalability, high yield, low cost and suitability for industrial implementation. Typically, the copper foil is exposed to gaseous hydrocarbons at high temperatures, which are catalytically decomposed forming graphene domains on the copper surface. This study focuses on transferring synthesized graphene with Chemical Vapor Deposition system on the piston ring surface. Firstly, it is synthesized graphene with CVD method. Then, it is transferred as monolayer graphene flakes coating piston ring. Graphene layers were confirmed by green Laser at 532 nm wave length with Raman peaks such as 1581 and 1582 cm^{-1} and 2D peaks at 2700 cm^{-1} band in Raman spectroscopy. Friction properties of graphene layers were tested experimentally in tribotest rig. Graphene coating showed lower friction value between piston ring and cylinder liner and tribofilms were presented by microscopic examination. It is advisable that graphene layers can be coated by transfer method and be used in the internal combustion engines.

Biography

Emre Çıtak was born in 1991 at Izmir in Turkey. He received his B.Sc. degree in 2014 and going on the master programme in Chemical Engineering Department of Selcuk University. During master programme, he has lead to research project on the graphene and carbonnanotubes with local funding. His special research areas are graphene, carbonnanotubes and nanomaterials and their applications. Emre Çıtak is director of GrafenBiotech Nanotechnology Co. Ltd. GrafenBiotech NanoTechnology Co. Ltd. was established in 2015 as a Nanotechnology start-up in order to produce critical Nanomaterials such as Carbon Nanotubes (CNT) and Graphene and create a local market on these materials in Turkey. After the successful Production of various types of Graphene, we began to study on the applications of different Nanomaterials including nanotubes, metal oxides, carbides, clay Nanoparticles and many others in projects funded by local funding agencies.

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Adaptive energy management strategy for a hybrid vehicle using energetic macroscopic representation

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The energetic macroscopic representation is used in this paper to model a pre-transmission parallel hybrid electric vehicle and its control and energy management system. Since optimizing energy management onboard is among the key factors in reducing consumption of hybrid vehicles, several strategies are developed in the literature such as instantaneous-optimization rule-based strategies and global-optimization strategies; however, being implemented separately and for different purposes. For instance, rule-based strategies serve for real-time operation, where the global-optimization strategies for benchmarking, as it lacks the ability to be used in real-time control. Hence, the combination of both strategies would result in close-to-optimal energy consumption through a real-time control system. Therefore, a simple adaptive rule-based strategy is presented in this study, based on short-term driving pattern recognition and the global optimization routine of dynamic programming.

Biography

Hussein Basma has completed his Bachelor's degree in Mechanical Engineering in May 2016. He is enrolled now in the Power Train Graduate Program at IFP School in France. He has been working as an Assistant Researcher at Lebanese American University in Hybrid Vehicles Topics.

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Demonstration of disturbance propagation in traffic flow for enhancement of vehicle platoon control system

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Disturbance propagation and string stability of a large vehicle platoon that consists of a part of the traffic flow is closely related to traffic shockwaves and oscillation. In this respect, the concepts of the estimation and prediction of shockwave propagation speeds and congestion should be considered in order to establish a control strategy for safe conditions without collisions even when the congestion is amplified in an unstable string of the large platoon. This means that an advanced approach for a car-following control strategy, which includes a time delay and non-linearity terms, is necessary for the enhancement of Vehicle Platoon Control (VPC) and the system robustness. In this research, we have demonstrated the effect of the disturbance propagation phenomenon on traffic flow stability. The traffic flow shockwave and oscillation are interpreted in terms of both macroscopic and microscopic approaches. We also discuss how the phenomenon affects VPC systems based on the optimal velocity model (OVM), which is an advanced car-following model. In addition, we improve the OVM, which is called the advanced OVM, by including a term for the delay time and by setting up a boundary condition of acceleration in order to enhance the VPC system and to ensure its robustness

Biography

Jinsoo Kim received the BS degree in Traffic Engineering from Hanyang University, Seoul, Korea, in 2010 and the MS degree in Traffic Engineering from Hanyang University, Seoul, Korea, in 2012. He is currently pursuing his PhD degree in Mechanical Convergence Engineering at Graduate School of Hanyang University. From 2013 onwards, he is Research Assistant with the Institute of Mechanical Technology, Hanyang University, Seoul, Korea. His research interest includes the development of intelligent vehicle and traffic systems through vehicle and traffic flow dynamics with optimal control. His awards and honors include the Global PhD Fellowship (National Research Foundation of Korea grant funded by the Korea government (MEST)), the Best Paper Award in Proceedings of the ITS Conference and the Prize of Korean Society of Transportation.

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Design of communize mounting system for 3 cylinder petrol and 4 cylinder diesel engine

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This paper describes powertrain mounting stiffness calculation which gives communize outer geometry for petrol and diesel powertrain and two different stiffness sets by achieving desired target of elastic and torque roll axis alignment and mode decoupling. First petrol 3 cylinder engine powertrain mount and stiffness is finalized by six degree of freedom calculations; next diesel four cylinder engine powertrain stiffness is relatively changed with respect to petrol stiffness such that to achieve desired target. Primary reasons for two sets of stiffness for petrol and diesel powertrain are weight, number of cylinder and inertia property difference. Lastly, both achieved stiffness are checked from manufacturing feasibility and accommodated in same mount outer geometry and checked in layout for packaging constraint. Same outer mount geometry helps maintain modularity, reduce FEA and packaging lead time and cost.

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MnCr-materials for new chassis lightweight concepts

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Forta H, Outokumpu has developed a special material exclusively for automotive applications. This material combines good formability with high strength, where the strength increases further during the forming process. These properties enable new lightweight concepts. The alloy design of the new lightweight material is based on an austenitic microstructure. During forming, this austenitic structure provides the formation of so-called "twins" and thus to increase the strength of the material enormously. Hence, the good formability can be ideally combined with a high strength. Traditional materials such as aluminum or carbon steels do not show this effect. The material is called "Forta H" and is industrially available. The base material "Forta H500", named after its yield strength, has a tensile strength of over 900 MPa with an elongation after fracture of more than 50%. By hardening, the grades "Forta H800" and "Forta H1000" can be achieved. The strengths of this special material increase during the forming process and in case of a crash. The material, developed for automotive applications, is widely tested and available on an industrial scale. It is offered in sheet thicknesses of t=0.5 mm to t=4.0 mm and a width up to b=1350 mm, where additional dimensions are conceivable. The presentation will provide an overview of the features and benefits of the new ultra-high- strength grades of Outokumpu. In this regard, a variety of results, such as weldability, formability, fatigue behavior, and corrosion resistance will be shown. Finally, some applications will be presented.

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Texting and walking: A controlled field study of crossing behaviors and inattentional blindness in Taiwan

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Literature has suggested that talking and driving constitutes a dual task that compromises the ability of driver's ability to maneuver the vehicle safely, and causes increased cognitive distraction and reduced situation awareness. Recent handsets with touch screens, as well as more advanced features including multimedia, and mobile applications (apps), exacerbate these problems. Considering the potential impact of phone use on driving safety, concerns have been raised about how texting, app use, and listening to music affect pedestrian safety. The current research attempts to investigate the effects of phone use (talking, texting, and listening to music) on the street-crossing behaviors of pedestrians. A controlled field study using video cameras was conducted. In the study, pedestrians crossing behaviors (e.g., crossing time, sudden stops, looking both ways before crossing, disobeying traffic signals), were recorded/observed. Pedestrians were classified into two groups: Experimental group (talking, texting, listening to music) and control group (no phone use). Pedestrians' inattentional blindness was also examined by evaluating whether they saw an unusual object (i.e., a clown) nearby. The personal attributes and handset characteristics (e.g., unlimited internet access, screen size, and smartphone) were used as independent variables. The results indicate that the proportions of unsafe crossing behaviors (e.g., sudden stops, disobeying traffic signals, not looking both ways before crossing) were higher among distracted individuals and more pronounced among those using instant-messaging apps. These instant-message app users were the least likely to see the clown, and music listeners were the least likely to hear the horn that the clown was honking. Contributing factors to unsafe behaviors include being a student, having a phone screen of 5 inch or larger, and having un-limited third-generation internet access.

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Fitness-for-service and residual stress analysis for automotive powertrain components using neutron diffraction

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The industry-wide push to develop advanced, low-displacement, high power density engines frequently demands increased operating temperatures and pressures for the powertrain components, such as engine heads, cylinder blocks, pistons, etc. At the same time, lightweighting has led to increasing use of aluminum alloys in these components. Both trends inevitably result in demand for higher-performing aluminum alloys and in the need to develop and test new alloying systems. An *in-situ* study of the creep behavior using neutron diffraction quickly reveals the response of individual crystallographic planes to the applied load under the operating-engine temperatures. This knowledge helps to identify the alloy chemistry and processing conditions that result in manufacturing engine components capable of sustaining the thermal mechanical loads over the expected life cycle of a vehicle, which typically exceeds 3000 hours. Residual stress in the as-cast engine components and efficient stress mitigation are further ongoing concerns for many OEMs. A series of neutron studies has been performed at the Canadian Nuclear Laboratories to evaluate how heat treatment techniques affect stress profiles along the cylinder web areas in engine blocks and between valve seats in aluminum engine heads. These studies have revealed the most critical information about the residual stress for development of manufacturing technologies that prevent distortion or cracking in the powertrain components.

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Distributed solar network for air ventilation in the hybrid vehicles

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It is very important to manage the power generation in the hybrid vehicles to maintain the highest possible efficiency. One of the most effective methods to increase the efficiency of the hybrid vehicle is use of auxiliary power sources for temporary loads inside and outside the vehicles. This allows the main energy source(s) to be used only to drive the vehicle and therefore increase the driven mileage. This paper presents a distributed solar network on the external body of the vehicles. The output of this solar network is connected to a buck-boost power DC-DC converter. This scheme is used to drive a ventilation system mainly to avoid temperature rise inside the vehicle especially in summer or when parked in sunny climate. This will reduce the degradation of the interior of the vehicle and help the air-conditioning to run effectively. The excess energy produced by this scheme is used to charge the main battery bank of the hybrid vehicle. A quantitative study of this distributed solar network will be presented to show the improvement in the overall efficiency and the lifetime of the vehicle.

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Experimental performance analysis of an automotive heat pump system for electric vehicles using HFC134a as refrigerant

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The use of electric vehicles has become popular due to their high energy efficiency and zero emission. However, comfort heating of passenger compartments in IC vehicles is performed by waste heat from IC engine, while electric vehicles (EV) employ electrical resistance for this aim due to having no waste heat source with sufficient capacity. Because providing heat from electrical resistance causes extra energy consumption, the use of air-source heat pumps for the comfort heating of EVs is getting importance to reduce total energy consumption in EVs. In this study, a bench-top automotive air conditioning system using HFC134a as refrigerant was set up and equipped with some auxiliary components to operate it as a heat pump. The system had instruments to measure refrigerant and air stream temperatures at critical points, refrigerant mass flow rate, refrigerant pressures, compressor speed and torque. The temperatures of the air streams entering the indoor and outdoor units was kept at two different values, namely 0°C and 10°C, and the compressor speed was changed between 800 to 2800 rpm with intervals of 400 rpm for each air stream temperature. The experimental data was acquired by a data aquisition system anddetermined that the automotive heat pump system provided sufficient heating capacity and conditioned air stream temperature at test conditions. It was observed that heating capacity and conditioned air stream temperature increased while COP_h decreased on increasing the compressor speed.

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Impact of sailing strategies on fuel consumption and the powernet system

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The engine stop-start system was a major advance to face the challenges of fuel saving of ICE vehicles. This technology requires significant changes of the electrical system like electrical energy management and cycle resistant starter batteries to ensure a reliable restart and sufficient energy supply during vehicle standstill. Latest developments are focusing vehicle sailing with engine off. This allows expanding engine off period as well as reduction of driving resistance during vehicle deceleration. An engine stop while sailing reduces fuel consumption significantly, but it also leads to considerably higher load on the electrical system. This investigation analyses the impact on fuel consumption and the electrical system by vehicle measurements and simulations. Basis is a state-of-the-art C-segment vehicle with DCT, enhanced stop-start and engine idle sailing. The enhanced stop-start system turns off the engine shortly before vehicle stop. The sailing function declutches the engine in situations without driver torque request while the engine remains in idle. Enhanced stop-start and sailing idle are evaluated by vehicle measurements under real world driving conditions. The battery as the most important electrical component is additionally validated on a component test bench. A powernet simulation is set up and calibrated based on experimental data of vehicle and component tests. An engine off sailing algorithm is implemented in the vehicle simulation environment. The effects on powernet voltage stability, energy balance and cranking ability are evaluated and compared to the estimated fuel consumption reduction. Starting from simulation analysis this study defines requirements for prospective automotive electrical systems to further reduce fuel consumption and emissions.

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Enhancement of internal combustion engine performance and cycle efficiency by optimizing the exhaust system based on simulation models

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The exhaust system is an indispensable part in any internal combustion engine, being responsible for the scavenging of burned gas discarding the excess heat. The exhaust system can extremely affect the engine cycle efficiency, where the pressure waves can ease or disturb the gas scavenging process. Small changes in both diameter and length of the exhaust headers lead to sensible variations in the engine's performance. A proper manifold design can save significant amounts of fuel. Thus, the focus in this paper will be comparing the various designs of exhaust headers and representing their effects on the engine performance. A wide range of designs are modelled in this paper, which will aid in optimising exhaust systems. An analytical approach is used to determine the most efficient exhaust headers design. The engine is modelled based on a Honda CBR 600 RR with a modified intake system, where a restrictor is installed at the air inlet, while the power train is modelled to simulate a formula student car. The model simulates the engine and its effect on the car's overall performance. Various exhaust configurations are implemented using this model, in order to demonstrate the effects on power, torque and efficiency for each design. The results show that simple modifications to the exhaust headers can save a considerable amount of energy compared to the conventional design, and in the same time maintaining a better engine performance.

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Novel method of atomization of automobile fuels into micro-droplets

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Fine droplets have developed surfaces offering enhanced rates of heat and mass transfer and result in higher efficiency of performance of automobile engines. Recently, new method of generation of mists of ultra-fine droplets has been developed in our laboratory. The invented liquid-atomization process is based on formation of ensembles of micro-sprays, and includes disintegration of bubble shells on liquid surface by gas jets. In the experimental studies, a prototype device implementing the new atomization method was utilized to generate droplets of two types of automobile fuels: 1) petrol, having research octane number (RON) of 95, and 2) diesel. The dispersant of the fuels was compressed atmospheric air supplied at room temperature and pressures in the range of 2-3.5 bar. The obtained droplet size distributions and droplet concentrations were measured using a Malvern Spraytec device. Flow rates of the generated droplet mists were examined by means of continuous weighing the fuel container during the atomization. The prototype device allowed production of ultra-fine mists of petrol droplets of 0.4-0.6 μm Sauter mean diameters (the corresponding arithmetic mean diameters were 0.2-0.3 μm) with volumetric concentrations in the range of 13-21 ppm and flow rates of 340-500 mg/s. For the diesel fuel atomization, the obtained mists had Sauter mean droplet diameters of 2.1-2.3 μm (arithmetic mean diameters among 0.4-0.6 μm), volumetric concentrations of droplets in the range of 22-27 ppm and flow rates of 20-45 mg/s.

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Design, development and validation of new engine head cover with advanced sealing system by using simulation tools

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The existing head cover is having external oil and blow by separation unit, which is not only costlier but also complex and leads to increase in the overall height of engine which was difficult to integrate in new variants of vehicles. Existing head cover sealing system was also not foolproof and with slight variation in part dimensions, there were high chances of leakage. A new head cover has been designed with internal baffle type oil and blow by separation system to ensure efficient separation and proper packaging of the system in new varients. The new system has been finalized after 26 DOEs of different wire mesh sizes and different baffle plate size and positions. The final system has two bowl shaped separation units with wire mesh with two cup type oil separation passages and one baffle plate for separating blow by. The system works on condensation and gravity method. The blow by is guided through a well-defined passage integrated in aluminum cylinder head cover itself. The blow by passage angle is decided to ensure minimum oil flow with blow by. The new seal has been designed with the head cover to ensure no oil leakage during engine running. The seal compression has been controlled by introducing a metal cup in bush and stopper assy which is used to ensure uniform compression of the seal. The metal cup controls the rubber bush compression which indirectly controls the compression of the seal. The complete head cover with advanced sealing system has been validated rigorously for durability, oil consumption; leakages, vibrations and oil carry over and have been proved a better solution over the existing design. Same methodology can be benchmarked for the other existing engine variants.

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Thermodynamic cycle analysis of mobile air conditioning system using HFO-1234yf as an alternative replacement of HFC-134a

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This paper presents thermodynamic cycle analysis of mobile air conditioning system using HFO1234yf as alternative replacement for HFC-134a. Under a wide range of working conditions (varying condensing temperature, evaporating temperature, sub cooling and sub heating with internal heat exchanger (IHX) and without internal heat exchanger) on simple vapor compression system, we compare the energy performance of both refrigerants - R134a and HFO1234yf. Result shows that without using an internal heat exchanger, at lower condensing temperature (35°C), mass flow rate increases about 27-32%, refrigerating effect decreases 22-25%, compressor work increases 4-6% and COP decreases about 3-5%. While at higher condensing temperature (55°C), mass flow rate increases about 35-42%, refrigerating capacity decreases 27-30%, and compressor work increases 8-13% and COP decreases 7-10%. Using an internal heat exchanger (IHX), these differences in the energy performance are significantly reduced. At lower condensing temperature (35°C), mass flow rate decreases about 18-22%, refrigerating capacity decreases 15-18%, compressor work increases 1-3% and COP decreases about 2-3%. At higher condensing temperature (55°C), mass flow rate decreases 23-28%, refrigerating capacity decreases 18-22%, compressor work increases 5-8% and COP decreases about 4-7%. The energy performance parameters of HFO1234yf are close to those obtained with HFC-134a at low condensing temperature and making use of an IHX. Even though the values of performance parameters for HFO1234yf are smaller than that of HFC-134a, but difference is small so it can be a good alternative to HFC-134a because of its environmental friendly properties with introducing IHX.

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Design, analysis and fabrication of an automotive F-N-R gearbox with spur-gear differential

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Power transmission is an inevitable part in any automobile. The power from the prime mover (engine/motor) is transferred to the wheels using a suitable transmission system. Various designs of gearbox have been developed in the past. In this paper, an F-N-R (forward-neutral-reverse) gearbox with a compact spur-gear differential is designed by following the design parameters for spur gear, for the required output torque of a vehicle. All the gears and casing for the gearbox is modeled using Solidworks tool. A simple and user-friendly shifting mechanism is designed for the gearbox, adding to comfort. A new spur-gear differential is designed, having spur gears to accomplish differential action, which is more compact and light-weight compared to a conventional differential, since the heavy bevel gear assembly is omitted. Different analyses such as static, dynamic (time-dependent), contact, modal and fatigue analyses are done using ANSYS software. The main objective is to design and fabricate a light-weight, efficient and compact F-N-R gearbox as a replacement to current models.

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Motor torque control algorithm to prevent rollover for in-wheel drive electric vehicle

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In this study, an in-wheel motor torque control strategy was proposed for a 4-wheel drive in-wheel type electric vehicle by considering the rollover risk, vehicle driving and handling performance. LTR (lateral load transfer ratio), which is the rollover index, is significantly relevant to the vehicle lateral acceleration. For reducing the rollover risk, the vehicle lateral acceleration must be decreased. Lateral acceleration depends on the vehicle speed and turning radius. These factors can be controlled by the in-wheel motor torque control. To develop the in-wheel motor torque control strategy, the LTR was calculated from the vehicle dynamics to estimate the rollover. Threshold of LTR was introduced using the vehicle specifiations. LTR error which is the difference between the threshold of LTR and actual LTR was used to control the front and rear motor torques. Motor control strategy was composed of two parts: First, to reduce the vehicle velocity, output torque of the in-wheel motors at all wheels were reduced depending on the amount of the LTR error. In addition, co-operative braking control was performed using the electro-hydraulic braking system. Second, to improve the handling performance, additional output torque control of the front in-wheel motors were carried out. Through the simulation results, it was found that the rollover risk was decreased as much as 30% by the in-wheel motor torque control compared to that of no control.

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Experimental performance analysis of flywheel regenerative braking energy storage system for hybrid and electrical vehicles

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The most significant problem is short range in electrical and hybrid electric vehicles (EV, HEV). There are various studies about higher energy density battery technologies and higher efficient internal combustion engines to overcome range problem. In this study, the kinetic energy storage system designed and experimentally investigated to increase range of EV and HEV with available battery capacity. Traditional vehicles lose their kinetic energy as heat energy when they want to slow down. However, if vehicles do regenerative braking, they can store some part of this kinetic energy in energy storage system. But most of the recuperated energy is lost as heat in braking mode. In this study, a Flywheel Energy Storage System (FESS) is designed to store vehicle's kinetic energy, which occurs braking of the vehicle. Mathematical calculations, design of the FESS have been done in a scaled down laboratory prototype. Simulation and mechanical production stages of the prototype and preliminary test results are also included in the full paper. Flywheel is an energy storage system that stores the regenerated energy as kinetic energy on a high speed rotating mass. Vehicle's electric motor is operated as generator during braking. The regenerated energy is transferred to the FESS' Motor/Generator (M/G) unit during deceleration of the vehicle. M/G unit is operated as motor mode and energy is stored as kinetic energy by accelerating the FESS. Then the stored energy transferred the vehicle's DC bus operating M/G unit as generator mode when vehicle needs energy to accelerate the vehicle. Thus there is no loss of kinetic energy converted into heat energy from the vehicle during breaking, is stored to be used again in FESS.

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Power loss elimination during clutch engagement in an automobile

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A clutch is a machine member used to connect the driving shaft to a driven shaft, so that the driven shaft may be started or stopped at will, without stopping the driving shaft. During an automobile drive, one can observe that during every gear shift, there will be a speed fall after engaging the clutch. After disengagement, due to the inertia of the vehicle, the clutch shaft momentarily rotates at a higher speed compared to the flywheel. Then after engagement, the speed fall is mainly due to the engaging of low speed flywheel and relatively high speed driven member. By temporarily preventing the engagement of the flywheel and clutch till flywheel crosses the speed of clutch shaft, the speed drop during engagement can be eliminated. Proposed design deals with this concept, by adding a free wheel unit to the clutch shaft so as to eliminate the speed drop.

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Magneto-Engine: Engine with the power of magnetic energy

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Today many people are opting luxury vehicles, which can deliver performance but at the cost of low mileage. Still the majority of the people stick to the mileage and it has become a social interest also due to green revolution. The main idea of my proposal is that we can use magnetic energy to reduce the fuel usage in running the IC engines. When the engine piston goes up and down inside the cylinder there will be a lot of friction and a part of the energy obtained by burning the fuel is wasted. Hence in-order to avoid the losses we can use the magnetic repulsion technique to overcome this problem. When the walls of the engine cylinder are made of permanent magnet and the pistons are also made of same material, there exists a magnetic force repulsion which will provide a small separation amongst them thereby reducing the losses. In this way the amount of fuel burnt per combustion cycle could be reduced by 20% and results in more mileage.

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Simulation of aerodynamic behaviour of a super utility vehicle

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The main objective of the study is to reduce the aerodynamic drag and increase the stability of the car on the road for a three dimensional full-sized Super Utility Vehicle (SUV) using computational fluid dynamics (CFD). The study calculates the pressure and the streamline of velocity around the car. The SUV baseline model in the simulation is Mercedes - Benz GL class model 2013. Modifications and aerodynamic add-on devices are used to improve the aerodynamic behaviour of the Mercedes - Benz GL class model 2013. There are many modern aerodynamic add-on devices which are used in this research, such as many types of the spoiler, ventilation duct, mud flaps, vortex generators, ditch on the roof and diffuser. New design of devices is used to improve the aerodynamic performance of the SUV model. All of these tools are used individually or in combination. The improvement of aerodynamics should not mainly affect the vehicles capacity and comfort. This study has dealt with three boundary conditions for the velocity of the air, one with airflow of 28 m/s (100.8 km/h), 34 m/s (122.4 km/h) and 40 m/s (144 km/h). At 28 m/s, an aerodynamic drag reduction of up to 25.64% compared with the baseline is achieved for Mercedes - Benz GL class, model 2013 with all modifications and add-on devices. It is clear that the use of ventilation duct has a significant effect in reducing aerodynamic drag.

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Safety system for four wheelers by seat belt

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A security factor in an automobile plays an enormous role in saving lives during accident. Accidents that happen during road trips are unfortunate and cause loss of precious lives. To minimize the loss of life several safety factors are being made mandatory; one among them is compulsory wearing seat belt. The seat belts keep the occupants positioned correctly for maximum effectiveness for airbag. If the seat belt is not locked properly the driver and co-driver are likely to get more injured during accident. Driver normally avoids seat belt or they will bypass from their chest and will lock the buckle to activate the airbag. In our project, we have designed a security based seat belt usage in a proper way. Our security system design allows the vehicle to start only if the seat belt is correctly locked. We also designed a system for co-driver. This technology is low cost but more effective. An LDR (Light Dependent Resistor) sensor is used for driver's safety, to ensure that he locks the seat belt correctly. Thus, the safety concern of driver and co-driver is improved.

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Modified rack and pinion speed control governor

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Our theoretical interpretation of the rack and pinion speed controlling governor was inspired by the basic "Cork Opener" used to open wine bottles. Our objective is to design a cheaper and efficient speed governor, to promote its use in the general public, to help in declination of high speed vehicle mishaps and to protect the environment from pollution by burning lesser amount of fuel. The gear controlled speed governor employs the rack and pinion mechanism in a way that is similar to the way it is used in a wing bottle opener but with reversed operation; the worm is modified into a cylindrical shaft that has teeth on the outer surface, it is placed centrally and is free from any rotational motion, the body consists of the housing which supports the two pinion gears on either side of the modified worm, the housing too is modified to monolithically hold a bevel gear at the bottom, the housing is in free rotation during operation owing to the rotation of the bevel gear which is connected to the rotating member of the engine or turbine. The pinion gears are in a perfect state of mesh with the modified cylindrical rack and are also connected to the arm or levers, the levers on either side hold the rotating mass (or balls) used to put inertial force in action. The cylindrical rack is extended beyond the housing on both sides; either side are held by a bush, the bottom side is extended further to be just above a spring rocker arm, similar to the one used for valve control in automobile engines and it is connected to the fuel supply throttle via a lever.

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Performance comparison of half and full toroidal traction drive CVTs

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Toroidal CVT is an ideal automotive transmission system in terms of simplicity, fuel economy and performance. It consists of two discs forming a toroidal cavity and a power roller enclosed in a casing containing lubricant at very high pressure. In order to get the CVT with lesser mechanical losses, efficiencies of full-toroidal and the half-toroidal drives are estimated analytically. The present investigation aims at establishing the design guidelines for the geometry and dimension parameters of this CVT layout for uniform axial loading and optimal ratio range. First a kinematic analysis is done in order to find the speed ratios followed by the dynamic analysis where forces on different parts are analyzed. For estimating the torque losses through the bearings, the SKF model for the frictional torque calculation (in case of ball /roller bearing) or hydrodynamic lubrication theory (in case of journal bearing), is used. These frictional torque losses are distributed among the input and output shafts depending upon the ratios of the final input and output torque. A fully developed isothermal fluid film contact model between the discs and rollers, based on the results of EHL theory, is used to evaluate the slip and spin losses. With this method, the traction coefficient and slip can be predicted within 10% accuracy which makes the optimum control of the normal force of the power transmitting contact of a toroidal CVT. The effects on efficiency due to variation in traction drive parameters (half cone angle, cavity radius, fluid property) are also found out.

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A novel four wheel vehicle

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A new arrangement of wheel location has been considered for a four wheel vehicle so that the turning radius can be reduced greatly. The front axle is to use one wheel only instead of two wheels of a conventional vehicle. The middle axle is to use two wheels and the rear axle is to use one wheel. The single wheels of the front and rear axle will be placed at the mid position so that the arrangement becomes symmetrical. This arrangement helps us to follow the law of correct steering for all angular positions. The steering mechanism will be such that the front and rear wheels will rotate equal amount but in opposite directions. A crossed four bar mechanism has been used to rotate the front and rear wheel while the vehicle is taking a turn. The rotation of each wheel will be 30 degree and the maximum steering error is 0.2 degree only. The wheels on the middle axle will not be rotated due to steering but are connected to the differential gear box to transmit motion. The intersection of the front and rear wheel axis will be always on the axis of the middle axle. Hence pure rolling will take place while the vehicle is taking a turn. The design enhances the life of the tires and parking of this vehicle will be easier. Each wheel of the middle axle shall have two tires so that it can bear more load and increases stability of the vehicle while taking a turn.

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A new paradigm for active suspension of vehicles

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Good passenger comfort, ride comfort and ride handling are sought after goals in modern cars. Passive suspension systems can offer only a limited performance when meeting these goals. Well established and emerging feedback control strategies like the sliding mode control, adaptive control, optimal control to name just a few, have found the problem of active suspension to be an attractive application. Active suspension systems can outperform passive and semi active systems but bring new problems with them with regard to ride and suspension safety. From a control point of view, suspension systems are uncertain systems affected by an unknown disturbance in the form of an unknown road profile. In the literature, road preview using special sensors or using lead vehicles in a convoy has been proposed by many researchers. Estimating the effect of unknown road profile and uncertainties without using special sensors is made possible by two new methods called Inertial Delay Control (IDC) and Disturbance Observer (DO) is a new paradigm that gives a remarkable performance. The estimation is made in real time with the help of measurement of sprung mass position and velocity. The methods of IDC and DO are further developed to do away with velocity measurement which is a costly and noisy affair, by developing the estimate using only the sprung mass position. The method of estimation is generalized to improve the accuracy of estimation. A remarkable feature of the method is to get a performance that is better than sky-hook without having to use a sky-hook damper. This talk develops the idea further to explore how the method can be employed to give ride comfort without losing on handling requirements. The new methods are further developed to handle the conflict between improving ride comfort and keeping the suspension stroke within the rattle space constraints. Comparisons are made with other prevailing methods like the Linear Quadratic Regulator. Novel nonlinear functions combined with the methods of IDC or DO enable making the compromise just when needed. The talk concludes by discussing future directions.

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Optimizing the efficiency of a gasoline engine, using self generated hydrogen–By utilizing the engine's dissipating heat energy of gasoline generated power for generating a secondary fuel in the form of hydrogen

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Use of hydrogen as a fuel in IC engines has been supported for years, particularly because of it's high combustion energy and power output; besides the non-toxic emissions.However, the development and research of hydrogen based engines has always been hindered by the issue of production and storage of hydrogen. In the context of our proposed hydrogen powered internal combustion engine, the primary fuel for powering the engine is still gasoline but we are utilising the loss of gasoline generated power by generating a secondary fuel in the form of hydrogen. A thermo-electric generator or a number of thermo-electric generators are employed on the engine exhaust which converts the engine generated heat energy into electric power. This electric power is then used to electrolyze the water to generate hydrogen. The hydrogen produced in the process is fed to engine, by blending it with gasoline supply, to re-use the power, lost in the form of heat from the engine. Modern gasoline engines have a maximum thermal efficiency of about 25% to 30% when used to power a car. In other words, even when the engine is operating at its point of maximum thermal efficiency, of the total heat energy released by the gasoline combustion, about 70-75% is rejected as heat without being turned into useful work. By using thermo-electric generators this power is recycled and used as a power source for carrying the electrolysis of water for the production of HHO gas. This gas is then blended (1-2% by Volume) with the air/fuel mixture and fed to the engine cylinder for combustion. The engine performance parameters (fuel consumption, thermal efficiency, power, etc.) now get enhanced by a significant amount. Also, reduction in amount of unburned hydrocarbons, CO-CO2 emissions, etc., is achieved.

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Effect of compression ratio and exhaust gas recirculation on diesel-biodiesel blends for performance and emission characteristics: An experimental investigation

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Experiments were performed on a 4-stroke, single cylinder, variable compression ratio (VCR) diesel engine with pure diesel as a baseline fuel and blends of diesel and biodiesel with 0.5% ethyl hexyl nitrate (EHN) at different compression ratios (CR) such as 15:1, 16.5:1, 18:1 and 19.5:1 and at 20% EGR. From experimental investigations, it is found that with increase in CR, better performance is observed. The increase in CR increases the cylinder gas pressure and temperature and also the mixture concentration at the end of the compression stroke. As a result of this, burning rate increases and consequently thermal efficiency increases. Maximum BTE obtained is 32.3% at a compression ratio of 19.5:1 when compared to 30.25% at 16.5:1. However, at higher compression ratios (i.e., at 19.5:1), NO_x emissions are higher and also increase in BTE is insignificant. Hence, optimum CR is 18:1.

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Analytical analysis of the xEV standards

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This paper provides an all-inclusive state of the art analytical analysis of major categories of electrified transportation (xEVs) standards, issued by the world wide standardization organizations. Firstly, the current status for the standards by major organizations is presented followed by the graphical representation of the number of standards issued. The review then takes into consideration the interpretation of the xEVs standards developed by all the major standardization organizations across the globe. The standards are then differentiated categorically to deliver a coherent view of the current status followed by the explanation of the crux of these standards. This detailed elucidation of the standards will assist the researchers, reviewers and experts to find all the standards available in open literature at one platform and compare the merits and demerits of various standards. Further, the description of the status quo of the xEVs sector in India is outlined, which is of significant importance considering the increasing influence of electric mobility in the Indian transportation sector. This work will be valuable, principally to the automotive industry, as reference for product development applicable to numerous worldwide markets.

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