2ND INTERNATIONAL CONFERENCE ON INNOVATIVE DESIGN, ANALYSIS & DEVELOPMENT PRACTICES IN AEROSPACE AND AUTOMOTIVE ENGINEERING

22nd - 24th February 2016

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The Automotive Research Association of India, India

Prof. Xian-Cheng Zhang, *Professor,*
East China University of Science and Technology, China

Programme Schedule

DAY 1 (22nd February 2016)

Time	Description
08.30 to 10.00 Hrs	**Registration**
10.00 to 11.00 Hrs	**Inauguration** at Vel Murugan Auditorium – Address by **Mr.Olivier LUCAS, Director of Future Systems, MBDA Missile Systems, France**
11.00 to 11.15 Hrs	**Networking Tea / Coffee Break**
Session 1	*Session Chair: Mr.François Falempin (MBDA) / Co-Chair: Dr.S.Senthil Kumar (Vel Tech)*
11.15 to 11.45 Hrs	**Plenary Talk** Prof. Dr.-Ing. Dieter Scholz, Hamburg University of Applied Sciences, Germany *(Promising Configurations for Future Passenger Aircraft)*
Session 2	*Session Chair: Prof. Dr.-Ing. Dieter Scholz (Hamburg Univ.) / Co-Chair: Mr.Subramanian (Vel Tech)*
11.45 to 12.15 Hrs	**Key Note Talk** Prof. Lung-Jieh Yang, Tamkang University,Taiwan *(The Wind-Tunnel Test and Unsteady CFD of an Ornithopter Formation)*
12.15 to 12.45 Hrs	**Key Note Talk** Prof. Philippe Devinant, Polytech Orleans – University of Orléans, France *(Increasing Aerodynamics Performance by means of Flow control)*
12.45 to 13.15 Hrs	**Key Note Talk** Dr. Sutthiphong "Spot" Srigrarom, University of Glasgow, Singapore *(Aerodynamics of Southern Hawker Dragonfly: Aeshna cyanea)*
13.15 to 14.00 Hrs	**Networking Lunch**

Session 3	*Session Chair: Prof. Avinash R. Arankalle (ARAI) / Co-Chair: Dr.G.Sivakumar (Vel Tech)*	
14.00 to 14.30 Hrs	**Key Note Talk** Prof.Dr.-Ing. Eckhardt Schneider, Fraunhofer IZFP / University of Saarland, Germany *(Ultrasonic Material Characterization and Testing of Anisotropic Components)*	
14.30 to 15.00 Hrs	**Key Note Talk** Dr.R. Mahadevan, India Pistons Ltd, India *(Strategies for Better Fuel Economy, Light Weighting & Friction Reduction in Cylinder Components of IC Engines)*	
15.00 to 15.30 Hrs	**Key Note Talk** Prof.Lanzhu Zhang, East China University of Science and Technology, China	
15.30 to 16.00 Hrs	**Key Note Talk** Dr V. Balasubramanian, Simpson & Co, India *(Quality, Reliability & durability)*	
16.00 to 16.15 Hrs	**Tea Break**	
Session 4	**Contributed Papers**	
	Dr.APJ.Abdul Kalam Conf. Hall (4103)	***Video Conference Hall (4101)***
	Aerodynamics and UAV *Session Chair: Prof. Philippe Devinant (Orleans)* *Co-Chair: Mr.S.Subramanian (Vel Tech)*	**Materials and Manufacturing** *Session Chair: Dr.S.L.Mannan (IGCAR)* *Co-Chair: Dr.S.Gowthaman (Vel Tech)*
16.15 to 18.00 Hrs	Prof. Dr.Ing. Dietor Scholz "Investigation of a Novel Turboprop Driven Aircraft Concept Including Future Technologies **(I-DAD 2016/148)**"	Prof. Jacky Y.-C. Hu, "Wiring the Tin-Silver-Copper Alloy by Fused Deposi-tion Modeling **(I-DAD2016/62)**"
	Mr. A. Shikhar Jaiswal, "Shape Parameteri-zation using Bezier Curves for Aerodynamic Shape Optimization **(I-DAD2016/67)**"	Mr. T.V.B.BABU, "Experimental Studies on Tig Welding of Ti-6al-4v Alloyplates using CAE **(I-DAD2016/66)**"

	Dr. S.Senthil Kumar, "Comparison of Turbulence Models in Simulating Axisymmetric Jet Flow **(I-DAD2016/124)**"	Mr. Hussain Najmi, "Flow configuration influence on Darcian and Forchheimer permeabilities determination **(I-DAD2016/68)**"
	Dr. A.T.Sriram "Design of an Aircraft Wing for Given Flight Conditions and Planform Area **(I-DAD2016/102)**"	Prof. Dr. Yi-Ta Wang," Effect of print angle on mechanical properties of FDM 3D structures printed with POM material **(I-DAD2016/78)**"
	Mr.K. Ramachandran "PreSTo Wing Module Optimization for the Double Trapezoidal Wing **(I-DAD2016/115)**"	Prof. Dr. Esakki Balasubramanian, "Taguchi's Parametric Approachin OptimizingSelective Inhibition Sintering Process Variables **(I-DAD2016/101)**"
	Mr. Arjav Malhotra, "Study of static stall characteristics of a NACA 0012 aerofoil using turbulence modelling **(I- AD2016/118)**"	Mr. Aswin Chinnaraj, "An experimental study on flow of micronized Silicon Carbide particles through sintered porous materials **(I-DAD2016/69)**"
	Mr.Nikhil V Nayak "Design and study of aerodynamics of wind-solar Hybrid system **(I-DAD2016/63)**"	Mr. K.S.Pujari, "Optimization of GTAW process parameters on mechanical properties of AA 7075 –T6 Aluminium alloy weldments **(I-DAD2016/82)**"
	Mr. Zakir Ilahi Chaudhary, "Experimental Investigation on the Effectiveness of Active Control Mechanism on Base Pressure at Low Supersonic Mach Numbers **(I- AD2016/83)**"	Dr. Raghuraman S, "Effect of Compaction Aspect ratio on Wear characteristics of Sinter Extruded Pure Copper processed through Powder Metallurgy route **(I-DAD2016/119)**"
18.15 to 19.30 Hrs	Cultural Programme by Students	
19.30 Hrs Onwards	**Networking Dinner**	

DAY - 2 (23rd February 2016)

Time	Description	
Session 5	Contributed Papers	
	Dr.APJ.Abdul Kalam Conf. Hall (4103)	***Video Conference Hall (4101)***
	CFD & FEA *Session Chair: Dr.L.J.Yang (Tamkang)* *Co-Chair: Dr.S.Senthil Kumar (Vel Tech)*	**Materials and Manufacturing** *Session Chair: Prof.Dr.Nicolas Gascoin (INSA)* *Co-Chair: Dr.S.Gokul Raj (Vel Tech)*
08.45 to 10.00 Hrs	Dr.M.V.RAMESH, "Finite Element Analysis of Surface Grinding Process using Nano Fluids **(I-DAD2016/79)**"	Dr.Jayaraman, "Al Agglomerate Size Measurements in Composite Propellant Combustion (**I-DAD2016/129)**
	Dr.Jaiswal B.L, "Resonance Behavior Of Steam Turbine Blades With Zigzag Lacing Pins **(I-DAD2016/81)**"	Prof. Avinash Arankalle, "Advances in light weighting materials for body-in-white (BIW) **(I-DAD2016/139)**"
	Dr. E.Balasubramanian "FEA of high strength polymers interaction with inhibitors in selective inhibition sintering process **(I-DAD2016/125)**"	Mr. Syed Alay Hashim, "Calculation of Theoretical Performance of Boron-based Propellant for Proposing it as High Potential Solid Propellant for Future **(I-DAD2016/110)**"
	Dr. P.Srinivasa Muthy "CFD Analysis of Flapping Wing for MICAV application **(I-DAD2016/134)**"	Ms.N.Pallavi Senapati, "Multi-Objective Opti. of EDM process parameters using PCA and TOPSIS method during the machining of Al-20%SiCp metal matrix composite **(I-DAD2016/117)** "

	Mr. Premkumar P.S "Performance Investigation Of High Temperature Combustion Technology (Hicot) Using CFD Simulation **(I-DAD2016/109)**"	Ms. Abirami K,"Investigations On The Influence Of Mechanical Behaviour Of Copper Aluminium Nickel Powder Compacts Processed Through Powder Metallurgy **(I-DAD2016/103)**"
Session 6	*Session Chair: Dr. Jean Marie Castelain (INSA) / Co-Chair: Mr.Pugazharasan (Vel Tech)*	
10.00 to 10.30 Hrs	**Plenary Talk** Mr. François Falempin, MBDA Missiles, France *(Hybrid Reusable Airbreathing Space Launcher – A Step by Step Approach Towards a Fully Reusable System)*	
Session 7	*Session Chair: Dr.S.L.Mannan (IGCAR) / Co-Chair: Dr.S.Gokul Raj (Vel Tech)*	
10.30 to 11.00 Hrs	**Key Note Talk** Dr. N. Eswara Prasad, DMSRDE, India (Advanced Aero Engineering Materials and Technologies)	
11.00 to 11.10 Hrs	**Networking Tea / Coffee Break**	
11.10 to 11.40 Hrs	**Inauguration of VISAI 2016 by** **Dr. Jean Marie Castelain, INSA Centre Val de Loire, France**	
Session 8	*Session Chair: Dr. N. Eswara Prasad (DMSRDE) / Co-Chair: Dr.S.Gowthaman (Vel Tech)*	
11.40 to 12.10 Hrs	**Key Note Talk** Prof. Xian-Cheng Zhang, East China University of Science and Technology, China *(High-temperature fatigue crack propagation of Ni-based alloys)*	
12.10 to 12.40 Hrs	**Key Note Talk** Dr. Shankar Venugopal, Cummins India Ltd, India *(Future Technology Scenarios for Urban Mobility in India)*	

12.40 to 13.00 Hrs	**Invited Talk** Prof. Guy Feuillard, INSA Centre Val de Loire, France *(Functional characterization of piezoelectric materials and application to ultrasonic transducers)*	
13.00 to 13.20 Hrs	**Invited Talk** Mr. Shafaqat Siddique, TU Dortmund University, Germany *(Fatigue and Fracture Reliability of Additively Manufactured Al-4047 and Ti-6Al-4V Alloys for Automotive and Aerospace Applications)*	
13.20 to 14.00 Hrs	**Networking Lunch**	
Session 9	*Session Chair: Prof. Guy Feuillard (INSA) / Co-Chair: Dr.R.Mariappan (Vel Tech)*	
14.15 to 14.45 Hrs	**Key Note Talk** Prof. Shaoping Zhou, East China University of Science and Technology, China	
14.45 to 15.15 Hrs	**Key Note Talk** Dr.P.A. Lakshmi Narayanan, Simpson &Co, India *(Optimisation of IC Engine Design for reduced emissions)*	
15.15 to 15.30 Hrs	**Tea Break**	
Session 10	Contributed Papers	
	Dr.APJ.Abdul Kalam Conf. Hall (4103)	***Video Conference Hall (4101)***
	Automotive Technology and Electronics *Session Chair: Dr.Shankar Venugopal (Cummins)* *Co-Chair: Dr.G.Sivakumar (Vel Tech)*	**Materials and Manufacturing** *Session Chair: Dr. N. Eswara Prasad (DMSRDE)* *Co-Chair: Dr.R.Mariappan (Vel Tech)*
15.30 to 17.00 Hrs	Mr. Ponnusamy.N, "Health Monitoring for Armoured Fighting Vehicles **(I-DAD2016/140)**"	Mr. S.Tripathy, "Optimization of process parameters and investigation on surface characteristics during EDM and Powder Mixed EDM **(I-DAD2016/121)**"

	Mr.Surender Dhanasekaran, "Cabin Control System on Temperature Impact using Occupant Detection Scheme for M1 Category Vehicles **(I-DAD 2016/143)**"	Dr. S.Gowthaman, "Evaluation of Tensile Properties of Natural Silk and Coir Fibers **(I-DAD2016/123)**"
	Mr.Shubham Thosar "Structural Performance Analysis of SAE Supra Chassis **(I-DAD2016/93)**"	Ms. Pallavi Chaudhury, "Optimization of process parameters of powder additive mixed electrical discharge machining by ANOVA method **(I-DAD2016/126)**"
	Mr.Akkaraju H Kiran Teja "Investigations on the performance of various bio-fuels along with low thermal conductivity piston crown in a diesel engine**(I-DAD2016/105)**"	Ms. Neetu Srivastava, "Rayleigh type acoustic streaming in a Planar Porous Channel **(I-DAD2016/76)**"
	Mr.Suraj R, "Optimization technique applied for method of evaluation of a controllable factor of chassis of FSAE car **(I-DAD2016/116)**"	Mr. S.Somasundaram, "Operating Characteristics of Multi Cylinder Petrol Engine using LPG With Methanol **(I-DAD2016/138)**"
	Mr.Mahesh P. Nagarkar "GA based Multi-Objective Optimal Control of Nonlinear Quarter Car Suspension **(I-DAD2016/136)**"	
	Mr. Antriksh Mutha, "Design & Optimization Of A Steering Knuckle Of FSAE Car **(I-DAD2016/133)**"	
18.00 Hrs Onwards	Press Meet	

DAY – 3 (24th February 2016)

Time	Description	
Session 11	Contributed Papers	
	Dr.APJ.Abdul Kalam Conf. Hall (4103)	***Video Conference Hall (4101)***
	Automotive Technology and Electronics Session Chair: Prof. Dr. Yi-Ta Wang (NIU) Co-chair: Prof.G.Sasikala (Vel Tech)	**Machines and Mechanics** Session Chair: Dr.D.K.Kharat (DRDO) Co-Chair: Dr.B.L.Jaiswal (Vel Tech)
08.45 to 10.00 Hrs	Mr. Utsav Bhardwaj, "An Automated System for motioning the Cargo for Ground and Air Operations **(I-DAD2016/65)**"	Mr. S R Mistri, "Design and construction of a RC, quick assembly / dismantlable, semi-rigid airship **(I-DAD2016/70)**"
	Dr.S.Jeyanthi "Fuzzy Logic Simulation for Brake by Wire Control System **(I-DAD2016/72)**"	Mr. Pavankumar AV, "Parametric Optimization of FSAE Restrictor for Random Vibrational Analysis **(I-DAD2016/100)**"
	Mr.VV.Jagirdar, "Handling Simulation and experimentation of an armoured Multi-axle Vehicle with Multi-axle Steering **(I-DAD2016/131)"**	Dr. Senthil Kumar.S, "A Study of Effect of Piston Bowl Shape on Engine Performance and Emission Charac. of a Diesel Engine **(I-DAD 2016-147)**"
	Mr. S. Yuvaraj "Design of Expert Combustion Monitoring System **(I-DAD2016/88)**"	Mr. Sivaraj.S, "Orbital parameters Variations of IRNSS Satellites **(I-DAD2016/141)**"
	Mr. Sumukh Surya,"Design and development of FPGA based MAGLEV System for a Low-speed wind tunnel **(I-DAD2016/107)**"	Mr. Eadala sarath Yadav, "Comparative approach towards Modified Smith Predictor and Back Calculation design for conical tank level process control **(I-DAD 2016-145)**"

Session 12	*Session Chair: Dr. Sutthiphong "Spot" Srigrarom (Univ of Glasgow)*	
10.00 to 10.30 Hrs	**Plenary Talk** Prof.Dr. Shan-Tung Tu, East China University of Science and Technology,China *(Recent Advacnces in High Temperature Structural Integrity)*	
10.30 to 11.00 Hrs	**Key Note Talk** Dr.D.K.Kharat, DRDO, India *(R&D Opportunities of Academia and Industries)*	
11.00 to 11.10 Hrs	**Networking Tea / Coffee Break**	
Session 13	Contributed Papers	
	Dr.APJ.Abdul Kalam Conf. Hall (4103)	***Video Conference Hall (4101)***
	CFD & FEA Session Chair: Dr.P.Srinivasa Murthy (ADE) Co-Chair: Mr.S.Sivaraj (ISRO)	**Machines and Mechanics** Session Chair: Prof.Jacky Y.-C. Hu (NIU) Co-Chair: Mr.Chandrakumar (Vel Tech)
11:10-11:45 Hrs	Ms. Madhumitha R, "Analysis Of Air To Air Rotary Regenerator For HVAC Systems Using CFD **(I-DAD2016/132)**"	Mr. Anirudh Satya, "Viabilities Of Replacing Combustion Engine By Electromagnetic Engine **(I-DAD 2016-144)**"
	Mr.Rohit R. More "Amphibious design and verification of river crossing capability of Armored Personal Carrier using CFD and model testing **(I-DAD2016/127)**"	Mr. Utsav Bhardwaj, "A Spring-activated Quick-response Mechanism for Legs of a Mooring Mast: Conceptual Design and Analysis **(I-DAD2016/128)**"
	Dr.M.Amala Justus Selvam "Study of the influence of the process variables on formability and strain distribution in incremental sheet metal working of aa 1050 sheets CFD & FEA **(I-DAD2016/137)**"	Mr. Arti Vishwanath, "Experimental and Simulation Study of Modified Acoustic Horn Design for Sonic Soot Cleaning **(I-DAD2016/71)**"
11.45 to 13.00 Hrs	Valedictory of IDAD and VISAI IDAD - Best Paper Awards & VISAI – Best Project Awards	
13.00 to 13.45 Hrs	**Networking Lunch**	

Contents

CONTRIBUTED PAPERS

SOUVENIR — 2nd International Conference on Innovative Design, Analysis & Development Practices in Aerospace and Automotive Engineering (I-DAD 2016). Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Hybrid Reusable Airbreathing Space Launcher – A Step by Step Approach towards a Fully Reusable System

Francois Falempin

MBDA - Le Plessis-Robinson, France

ABSTRACT

By combining the high-speed air breathing propulsion with a conventional rocket engine (combined cycle or combined propulsion system), it should be possible to improve the average installed specific impulse along the ascent trajectory and then make possible more performing launchers and, hopefully, a fully reusable one.

During the last decades, a lot of system studies have been performed in France on that subject within the framework of different and consecutive programs (Ref[1]). Nevertheless, these studies never clearly concluded if a space launcher could take advantage of using a combined propulsion system or not. As a matter of fact, past studies were performed sometimes by different teams with different tools and hypothesis. By another way, these studies used systematically a very conservative approach in term of vehicle airframe configuration (airplane like) and it is doubtable that the best trade-off between air breathing propulsion mode needs and the mandatory low dry mass for the vehicle and its propulsion system was obtained with the considered vehicle concepts.

MBDA took an active part of these studies and, based on that experience, a brief review of some of the main design issues of a future space launcher using combined propulsion leads MBDA to propose a specific space launcher concept taking into account the progress made these last years in the related technologies.

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Functional Characterization of Piezoelectric Materials and Application to Ultrasonic Transducers

G. Feuillard*, J. Fortineau, F. Vander Meulen, F. Levassort and **M. Lethiecq**

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ABSTRACT

Transduction phenomenon in the MHz range is mainly realised by means of piezoelectric materials, such as ferroelectric lead zirconate titanates. The material requirements for new ultrasonic transducer applications, has brought materials research and device development closer together. Several measurement techniques developed to characterise piezoelectric materials and structures are presented. The first method is based on harmonic measurements of the electrical impedance of a sample. Characterisation of thick films and single crystals are reported using this technique. The second method uses the measurement of transmission coefficient of an ultrasonic plane wave through a piezoelectric plate as a function of frequency and angle. The full tensor characterisation of a PZT piezoelectric plate is reported and compared with characterisations using other methods. Finally, the implementation of the spectroscopic resonance method applied to a piezoelectric cube for full tensor characterisation is presented. Results are discussed in term of potential application to ultrasonic transducer.

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Promising Configurations for Future Passenger Aircraft

Prof. Dieter Scholz

Hamburg university of Applied Sciences,Germany
Email: info@profscholz.de

ABSTRACT

Passenger aircraft carry passenger with their baggage and often additional cargo over a certain distance or range. Passenger, baggage and cargo are called payload because they generate revenue for the airline operating the aircraft for profit. An aircraft consists of major components. For a conventional aircraft these components are one fuselage, one wing, a horizontal tail and a vertical tail. Horizontal tail and vertical tail are together called empennage and are located aft. An unconventional configuration deviates in one or more aspects from the definition of the conventional configuration.

Aircraft burn fuel to CO_2 and dump CO_2 and other pollutants into the atmosphere. Fossil energy resources are final and the atmosphere has limits to the amount of pollutants it can take. Hence a reduction in fuel consumption is paramount to the life cycle balance of aircraft. All aeronautical disciplines (aerodynamics, structures, propulsion …) have their share in researching ways to reduce fuel consumption of aircraft. Aircraft design is responsible for the aircraft configuration and for integrating fuel saving technologies from other aeronautical disciplines into the aircraft.

A promising configuration for future passenger aircraft is a conventional or unconventional combination of major aircraft components integrating also the effects of new technologies from other aeronautical disciplines such that operating costs are reduced by also reducing fuel burn considerably. Today the dominant configuration for passenger aircraft is the conventional configuration with a low wing and engines in nacelles mounted with pylons to the lower side of the wing. This configuration has evolved during decades of aircraft design, production and operation with the objective to reduce operating cost.

There is not just one promising aircraft configuration for future passenger aircraft with reduced fuel consumption. Depending on payload and range requirements different configurations can be proposed.

For very large aircraft with more than 1000 passengers the wing becomes the dominating major component and the Blended Wing Body (BWB) configuration should be chosen. The Blended Wing Body consists of a wide lift generating fuselage blending into conventional outer wings. Similar to a flying wing the BWB has no horizontal tail. One or two vertical tails should be included. The BWB has a low wetted area compared to its wing area. It has a higher L/D compared to conventional aircraft due to lower zero lift drag. Problematic for the BWB is its structural layout as a passenger aircraft that needs a pressure cabin. Not solved is the integration of supercritical airfoils and the requirement for static longitudinal stability for civil certification. Difficulties come from evacuation after ditching and from landing gear integration.

For the typical short to medium range aircraft with up to 200 passengers (in mixed class cabin layout with one aisle) a turboprop aircraft with large propeller diameter should be chosen. Innovative is here the choice of a propeller for bigger aircraft which are so far only available as jets. The propeller has a higher propulsive efficiency than a jet. In contrast to the unducted fan, the path to certification of a propeller aircraft is known. Cabin noise should be kept low with additional sound insulating material. Starting from a reduced fuel mass, aircraft mass goes down further from snow ball effects including increased aspect ratio within the span limited wing to 36 m of ICAO class C. The concept can benefit further from a strut braced wing with natural laminar flow. This configuration is further detailed in the conference proceedings.

Most important for an efficient aircraft design is a high aspect ratio. For a given span (at the airport) the effective aspect ratio can be increased with winglets, folding wings, or with a box wing. The Box Wing Aircraft (BWA) consists of two wings of half chord (compared to the conventional reference aircraft) in a biplane layout with winglets connecting the wingtips. All these solutions have disadvantages and it is proposed to offer instead the option of (horizontal) wing tip extensions to standard layouts (conforming to ICAO span limits) just violating the span limit and as such accepting the next larger ICAO category for the aircraft.

With the ideas above, we have assumed that fossil fuel will still be available in the future. If this is not the case, fuel has to come from some regenerative process. Biofuel production is not a regenerative process (as has been shown by other authors). Regenerative electrical energy (e.g. from wind, water, or sun) needs to be

used instead. If this energy is stored in batteries on board of the aircraft, range is limited to only about 700 km due to the weight of the batteries. When electrical energy is converted to hydrogen (electrolysis), it can be used in gas turbine engines (turbofan, turboprop), and medium range flight is easily possible. However, the aircraft configuration needs to be adapted due to the larger volume of the liquid hydrogen (LH2) with its low density compared to jet fuel. It is recommended to stretch the fuselage and to install the hydrogen tanks in front and aft of the cabin. Research is on the way to directly convert energy to hydrocarbons. Fuel which can be used as a full substitute or in a mixture with today's jet fuel is called drop-in fuel. Synthetic fuel is a drop-in fuel. It could be used even in older aircraft without the need for any modification of the aircraft.

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Ultrasonic Material Characterization and Testing of Anisotropic Components

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ABSTRACT

All components are more or less anisotropic. In many cases the anisotropy is beneficial and reduces the quality costs as e.g. of the deep drawing process of automotive parts. In other cases the aniso-tropic behavior is tried to be reduced e.g. in order to minimize the deflection of rolled parts during machining. During the ultrasonic testing of anisotropic components the anisotropy causes a beam skewing and hence difficulties to precisely localization detected defects. The characterization of anisotropy is an issue and ultrasonic techniques offer appropriate possibilities applicable on automotive and aeronautical components.

The anisotropic structure of the metallic single crystal causes a more or less significant direction dependency of material properties. Most of the automotive and aeronautical components are of Al- and Fe- alloys exhibiting a texture, means a preferred grain orientation. Among others, texture causes direction dependent elastic, plastic and electro-magnetic properties. The evaluation of X-ray pole figures is a widely used method to describe texture quantitatively, a variety of mechanical and magnetic techniques are in use for the quantitative texture analysis. The mentioned state-of-art techniques request samples of the component. Ultrasonic technique allow a nondestructive characterization of the anisotropic material behavior and the testing of components exhibiting anisotropy.

The contribution presents in its first part the potential of ultrasonic techniques to evaluate texture of components and to characterize texture.The elastic anisotropy of fcc and bcc single crystals is described in terms of the ultrasonic velocities and the change of the times-of-flight of different ultrasonic wave modes are used to determine the texture symmetry axis and to evaluate the strength of the texture.

Correlations of ultrasonic time-of-flight data are used to characterize the drawability parameters of rolled products which will be cold or hot pressed into e.g. automotive body parts.Among others texture also influences the stiffness and strength values of Al- and Fe-alloys. Ultrasonic techniques enable the evaluation of the mentioned quality measures and hence supports the appropriate heat treatment of the parts. Stress states also cause a direction dependent elastic behavior and inhomogeneous distributed residual stress states cause e.g. spring back reaction of sheets and plates during the cutting and shaping process of the part. The ultrasonic stress analysis supports the needed heat treatment and the optimization of the machining sequence.

The second part deals with the ultrasonic testing of anisotropic structures as e.g. welds of austenitic steel on one side and particle and fiber reinforced components on the other. The orientation of the dendritic structure of an austenitic weld causes beam skewing resulting in significant errors of the localization of welding defects. Using basic results of experimental investigations performed on samples cut from a real austenitic weld, a technique is developed to iteratively evaluate the appropriate material elastic constants and hence tocalculate the skewing angle and to correctly localize the welding defect. In particle reinforced metallic (MMC) or ceramic (CMC) components the transversal isotropy of particular planes are a quality measure. The application of linear polarized ultrasonic shear waves allows the check of that measure. The determination of the glass or carbon fiber orientation in reinforced components using the direction dependent change of ultrasonic times-of-flight is limited to thin sheets and plates because of the high ultrasonic attenuation of that material.

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Optimisation of IC Engine Design for Reduced Emissions

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ABSTRACT

The subject of reciprocating engines revolves around efficient combustion with emissions lower than legal limits and transferring the power safely to the shaft. Engineers work with various models for combustion and power train. However, we understand only about 80% of what happens inside the engine even when advanced simulation techniques based on multi-physics is carried out. To verify or improve combustion in the engine, various parameters are to be measured either at steady or at transient states. In this lecture, we are presenting measurement of some important parameters namely airflow, egr flow, combustion performance and ammonia.

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The Wind-Tunnel Test and Unsteady CFD of an Ornithopter Formation

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ABSTRACT

According to Lissaman and Shollenberger's article published in Science in 1970, birds fly in formation to reduce the overall energy expenditure for flight. Thus this work adopted the same principle of flight formation to ornithopters to save energy. Two experiments and one numerical simulation try are described herein. In the first experiment, a rigid frame housing three ornithopters was made and a tethered flight of it around a fixed suspension point was performed to evaluate the cruise performance of the ornithopter formation and check for energy saving by monitoring the endurance against a known reference value. In the second experiment, a jig housing three ornithopters was subject to a wind tunnel test at the Wind Engineering Center of Tamkang University. The aerodynamic force evaluation of the formation was done. From the preliminary examination, it is found that 3 m/s, 10˚ angle of attack was the best case for ornithopter formation subject to 14 Hz flapping to generate largest lift and thrust. In the unsteady numerical simulation using COMSOL-Multiphysics, the simple case of two flapping wings dogging streamwisely was demonstrated. The upstream condition of 1 m/s and 20˚ angle of attack was formulated and the output instantaneous resultant force on the flapping wings reveal the obvious difference from the single flapping case. When compared to the real birds flying in a formation, the energy saving of ornithopters may be further improved by replicating the dynamic adjustments of frequency, phase change and separation among neighboring ornithopters, to obtain best energy-saving results in the future.

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Strategies for Better Fuel Economy, Light Weighting & Friction Reduction in Cylinder Components of IC Engines

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ABSTRACT

Automotive OEMs have been working on various technologies for reducing CO_2 emissions and improving fuel economy in their vehicles. Among the strategies that are being employed relating to the IC Engine, light weighting and friction reduction are the two areas that have received special attention. As the Piston assembly has a direct influence on the friction power of the engine, attempts have been made to reduce the reciprocating mass and improve friction through innovation in design materials and manufacturing processes. Improvements in design and manufacture of pistons and new surface coatings for Pistons & Rings have been able to significantly reduce friction and improve fuel economy. Some of these developments are discussed in this paper.

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Fatigue and Fracture Reliability of Additively Manufactured Al-4047 and Ti-6Al-4V Alloys for Automotive and Aerospace Applications

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ABSTRACT

Metal additive manufacturing is at a stage that it can now be used not only for rapid prototyping but for rapid manufacturing of functional components as well. However, for the reliable employment of parts, their mechanical performance is an important parameter not only in terms of their quasistatic strength but their fatigue performance for dynamic applications. Their fatigue performance should be at par with that of conventionally manufactured alloys. There can still be reliability issues for the additively manufactured parts, as the specific issues - remnant porosity, surface finish, residual stresses and fatigue scatter - are influenced by the selected process parameters. This paper presents the state-of-the-art of fatigue performance for additively manufactured Al-4047 and Ti-6Al-4V and ways to improve and manipulate the part properties. The results show that their mechanical performance is comparable, even better in some cases, to that of conventionally manufactured materials if appropriate processing parameters and post-processing techniques are employed.

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Future Technology Scenarios for Urban Mobility in India

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ABSTRACT

Our ability to ensure clean and convenient mobility in our cities is key to the sustainable growth of our economy. Volatile fuel prices, rising levels of emissions (and associated problems like smog) and traffic congestions are the key challenges that we face in most Indian cities today. We need the best of our young minds to look at emerging technologies, like smart and connected vehicles, to overcome these challenges. I expect that urban mobility, both personal and commercial, will be shaped by disruptive technologies such as: the move to on-demand mobility, the impact of autonomous vehicles and the growth of electric vehicles. I will present future technology scenarios and describe technology innovations that could help us to respond to these future scenarios.

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Recent Advances in High Temperature Structural Integrity

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ABSTRACT

In the last decade there has been an increasing need of structural integrity technology due to the construction of high temperature installations (eg. aeroengine, ultra- supercritical power plant, ethylene cracking plant and advanced nuclear power station) in China. To ensure the safe design and long term reliable operation of the high temperature components, some fundamental issues concerning the deterioration and failure of the materials and structures should be investigated. The lecturesummarizes the progresses in recent years in the development ofhigh temperature constraint fracture theory and failure assessment techniques. It comprises three major parts:

Part I: Determination of creep properties. Testing principles are proposed to determine creep properties by use of non-traditional specimens.

Part II: High temperature constraint fracture theory. The influences of in-plane and out-of-plane constraints on high temperature fracture are studied. A unified constraint parameter is proposed to modify the current creep crack growth law.

Part III: Damage mechanics based failure assessment. A new multiaxial creep-damage model considering the cavity growth and microcrack interaction. Special emphasis is put on developing and validating the multiaxial creep ductility factor.

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Aerodynamics of Southern Hawker Dragonfly: Aeshna Cyanea

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ABSTRACT

This paper is a part of our ongoing development of micro-aerial vehicle (MAV) that has the flight attribute similar to a dragonfly. The analysis is focus on aerodynamics characteristics of a dragonfly in hover and cruise modes, by using the ANSYS® Fluent software (Release 14.0). Dragonfly is well known for its supreme flight maneuverability. It has four independent flapping wings which is controlled by two muscles named elevator muscles to pull wings up and depressor muscles to pull wings down. These two muscles led dragonfly to create several phase differences between forewing and hindwing. With various phase differences generated, dragonfly is able to do many flight modes such as forward flight, sideway flight, sharp turn, hover, fly backward and even mating (tandem flight) in the air. Furthermore, dragonfly has developed its wings to be pleated such that can trap vortex inside. This type of wings enhance the lift creating capability for dragonfly. The species of Southern Hawker or Blue Hawker [Aeshna cyanea] are selected in this research. This subdivision of dragonfly is fascinating because it is considered as one of the fastest dragonfly on earth.

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Wiring the Tin-Silver-Copper Alloy by Fused Deposition Modeling

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ABSTRACT

This paper aims at investigating the feasibility of extrusion and molding a low melting-point metal, Sn-Ag-Cu alloy, on a substrate by Fused Deposition Modeling (FDM). Two Sn-Ag-Cu alloys, one is eutectic Sn-3.0Ag-0.5Cu (SAC305) and another non-eutectic Sn-0.3Ag-0.7Cu SAC307, are studied for their molding resolutions, material compositions, tensile strength, tear strength, and sheet-resistivities after FDM process. The FDM system is assembled by the authors. The molding resolutions are measured by caliper and micrometer. The material compositions are analyzed by Energy Dispersive Spectrometer (EDS). The tensile strengths and tear strengths are measured by Lloyd-LS1 tensile tester. The sheet-resistivities are measured by four-point probe station. Some conclusions are drawn according to the experiments. For better resolution, the extrusion temperature is a little higher than the melting point of the material. The FDM process significantly reduces the tensile strength of the materials. For the tear strength, SAC305 is better than SAC0307. The higher the extrusion temperature is, the higher the sheet-resistivity is.

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Design and Study of Aerodynamics of Wind-Solar Hybrid System

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ABSTRACT

The Government of India has sanctioned funds for production of 190 GW in this direction and this solution is a way to reduce the pollution levels. This support of the go-green initiative by the united nations as well and is a step forward in creating a better environment for the future generations to live in.The proposed work aimed at designing a wind-solar hybrid system for light load application. The tools like Qblade and solidworks were used to model and analyze the wind turbine system, the material used for the blade and hub was balsa wood and the tower a tripod type. The power output of 100 W at an average wind speed of 4.5 m/s has been targeted. The work also aimed at providing electricity to the rural area in India which amount to 25000 in number where there is no provision for electricity, this solution may provide the electricity needs of such villages

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An Automated System for Motioning the Cargo for Ground and Air Operations

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ABSTRACT

There are instances encountered very often when some cargo items are to be loaded to or unloaded from some motored vehicles operating on ground, or some commercial cargo aircrafts. This is one of the key requirements in case of scenarios like occurrence of some natural disasters like floods, earthquakes, cloud-burst, cyclone, etc.; post war situation; etc. Food packets, drinking water, communication devices, etc. constitute a major fraction of cargo in such cases. Pace and quickness of delivery of aid material becomes one of the major concerns then, since generally a huge number of people are affected by these disastrous events. We need quick loading and unloading of cargo then. To ensure fast loading of cargo on to the trucks and more especially cargo aircrafts, quick unloading at the desired site, as well as quick airdrop, an automated system has been designed for the same at CFI, IIT Madras. This paper explains the conceptual design of that automated system. The dynamics of the system have been discussed and some force analysis of the cargo motioning process has been carried out.

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Experimental Studies on TIG Welding of Ti-6AL-4V Alloy Plates using CAE

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ABSTRACT

Welding is a permanent metal joining process in which molten metal is applied in the joint with or without applying pressure and heat. Filler material is chosen in such a manner that it is exactly as the parent metal when solidified after welding. A weld can be qualified as good weld as it should not have any surface or internal defects and its weld strength should be close to the parent metal. One such attempt is made in this project. Thorough study of basics of welding. TIG welding, Ti alloy and welding simulation in ANSYS. Based on the study initial trials were carried to simulate welding in CAE. Results like thermal distribution and structural distortion were obtained for various parameter combinations and suggested for welding. Welding was carried out based on the parameters suggested and resulted in a good weld.

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Shape Parameterization of Airfoil Shapes using Bezier Curves

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ABSTRACT

Shape parameterization plays an important role in aerodynamic shape optimization process. The parameterization method used for optimization must be able to accurately model the aerodynamic body and also it should be flexible enough to take all the possible shapes in the design space. In this paper we have studied Bezier curve approximation of airfoil using 4th order, 6th order and 8th order Bezier curves. We observe that 6th order Bezier can accurately model the airfoil shape. In order to represent an airfoil using Bezier curves we have to find control points vector P and vector t of nodes, where each node corresponds to one data point. An iterative process with an initial guess of vector t was used to find the best possible control points vector P and vector t. Two different airfoil geometries were modeled using Bezier curves in this paper. The results for both the airfoil problems show that 6th order Bezier curves can model airfoil shapes accurately. Also new shapes can be produced easily from Bezier curves just by moving the control points, hence Bezier curves can be used to parameterize aerodynamic shapes for shape optimization problems.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Flow Configuration Influence on Darcian and Forchheimerpermeabilities Determination

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ABSTRACT

Within the framework of fuel cells, porous materials are used for the filtration purpose. Determining physical properties like porosity and permeability are of utmost importance to predict and manage filtration efficiency of these materials. Permeability of material is often determined experimentally in laboratory with disc samples (the fluid is flowing through the porous material) that are not exactly similar to the tubes of realistic operating conditions (fluid is mainly flowing tangentially to the surface and only a small part is flowing through the material). Thus, the effect of a secondary outlet on the Darcian's permeability characterization should be studied. In the current paper, we present a new test bench to determine experimentally the Darcy's and Forchheimer'spermeabilities for a porous media by taking into account two outlets.The pressure, mass flow rate and temperatureare registerdfor 3 different setup: with secondary outlet (S.O) a)0%, b) 50% and c) 100% open. Then Darcy's and Forchheimer's permeabilities for these 3 cases are calculated and discussed in detail. It has been found that the S.O opening does not affect the Darcian's permeability but have substantial influence on the Forchheimer's one.

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An Experimental Study on Flow of Micronized Silicon Carbide Particles Through Sintered Porous Materials

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ABSTRACT

Transport of suspended particles in porous media occurs in numerous processes of civil engineering and aerospace engineering. Literature survey indicating the mechanism of movement of suspended particles through porous media and the subsequent damage in engineering environment are not sufficiently known. This paper deals with a new concept of a laboratory test bench which permits to better understand the mechanism of particle intrusion into porous media. The results of the laboratory studies on the flow of suspended particles (Silicon Carbide) through sintered porous material (Stainless Steel) are discussed. The effects of flow rate and particle concentrations on the amount of damage (i.e., permeability impairment) and depth of penetration (from inlet towards outlet) are emphasized particularly.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Design and Fabrication of a Quick Dismantlable Remotely Controlled Semi-Rigid Finless Airship

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ABSTRACT

Remotely controlled airships are very much suitable for aerial photography, product promotion, and surveillance. This paper describes a methodology for sizing and design of a small semi-rigid airship that can be quickly assembled or dismantled. The airship is meant for flight demonstrations and as an aerial platform for indoor surveillance. The propulsion system is a novel design where the differential thrust and swiveling motors control the entire flight regime, with no fins or control surfaces. Topics such as all-up weight estimation based on payload weight, envelope sizing calculations, design and fabrication of a quick dismantlable semi-rigid structure design are covered.

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Experimental and Simulation Study of Modified Acoustic Horn Design for Sonic Soot Cleaning

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ABSTRACT

Ash deposits and dust particles are formed inside process equipments like boilers and electrostatic precipitators; and in material handling equipments like hoppers and silos during its operation. These deposits hinder the working of the equipment, gradually reducing its efficiency. So, removal of these deposits at regular intervals is necessary for smooth operation of the equipments. Sonic soot cleaning is a method which uses sound waves to dislodge the deposits. It employs an acoustic horn which is the source to produce sound and is designed such that it produces a frequency of sound that matches with the natural frequency of the particles to be cleaned.

In this study, modified geometries of an acoustic horn are designed and fabricated so that the desired sound pressure level (SPL) and frequencies are obtained for effective cleaning. The frequency can be reduced by increasing the horn length. The increase in length however causes installation problems, due to space constraint. To overcome this problem, numbers of bends are introduced to increase the overall length of the horn. Using these modified designs; frequency and sound pressure level are obtained experimentally as well as by conducting simulations for all cases, and results obtained from both are compared. It is seen that for the case where horn is attached to 6, 8 and 10 number of bends; frequency obtained fell in the range of desired frequency. The percentage of error obtained after comparison is found to be within acceptable limits.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Fuzzy Logic Simulation for Brake by Wire Control System

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ABSTRACT

Brake by wire technology which describes the replacement of conventional components such as the pumps, brake fluids and vacuum servos and master cylinders with electronic control unit, sensors and actuators. In this paper shows designing of an electromagnetic braking system which controlled by fuzzy logic technique, here electromagnetic braking system which controlled by two input parameters those are applied brake pressure and load acting on a vehicle. These input components connected to ECU. When the sensors sense the brake pressure and load it gives to controller. And controller goes to fuzzification and finally it gives the required voltage of front and rear axle brakes. Mechanical braking system is efficient but it having some drawbacks such as due to mechanical components causing high vibrations, higher stopping distance, brake fluid causes corrosion and its effect on environment and it occupies more space. All these drawbacks overcome by Brake by Wire system.

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Rayleigh Type Acoustic Streaming in a Planar Porous Channel

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ABSTRACT

A theory is developed for the boundary layer analysis of the passive methods to control the noise. The emphasis of the present treatment is on materials where fluid and solid are of comparable densities for instance in case of water-saturated rocks. It is found that the flow may be described by two non-dimensional parameters and a characteristic frequency.

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Effect of Print Angle on Mechanical Properties of FDM 3D Structures Printed with POM Material

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ABSTRACT

Fused deposition modeling (FDM) is currently the most popular form of 3D printing. Using this technique, the materials are stacked layer by layer. This study investigates how to increase the mechanical strength of the structure by changing the direction of structure using ANSYS Workbench, SolidWorks 3D Computer Aided Design software (CAD) software, and Umaker (3D printer). The study was divided into two parts. In the first part, model data samples were im-ported into ANSYS for analysis prior to printing. The models were drawn using the SolidWorks software. The second part used the Umaker 3D printer to print the samples using the polyacetal material (POM). The structures were made using three different directions, 0°, 45°, and 90° of the fused deposition modeling machine. Test specimens were fabricated according to the ASTM D638(ASTM, 1997), type I standard. The mechanical integ-rity of the samples was assessed using tensile strength tests. The tensile strengths at specified angles of the structure were compared across specimens of each direc-tion type. The results showed that the strength values of the 45° direction type were 65–72% of those of specimen in the 0° direction type demonstrating that di-rection is a relevant factor in the mechanical integrity of 3D printed structures. Us-ing the results of this study, the life span and mechanical strength of 3D printed structures can be increased.

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Finite Element Analysis of Surface Grinding Process using Nano Fluids

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ABSTRACT

The main aim is to investigate on the Grinding process and to improve the surface characteristics like surface finish and micro cracks and surface topography from micro level to nano level using carbon nano tube based on nanofluids. Carbon nanotubes are having high Mechanical and electrical Properties specifically high heat transfer capacity of 6000 w/mk. By using this property the multi-wall carbon nanotubes mixed with coolant of SAE20W40 oil in grinding process to investigate on the surface characteristics like surface roughness of AISI D2 tool steel work piece materials which are used more in moulds and dies. Carbon nanotubes increases the heat carrying capacity, thermal conductivity of the lubricating oil and thus prevents any scratch to the work as well as the nano particles participate in the machining process and fill the micro voids generated during the machining operation and give a better surface finish.

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Resonance Behavior of Steam Turbine Blades with Zigzag Lacing Pins

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ABSTRACT

The paper highlights the contribution of zigzag lacing pins, which are assembled in LP stages of some of the steam turbines. The result of experimental investigations, on a prototype rotor establishes that these zigzag pins play a major role in forming a disc like structure at high speeds. For such blades conventional Campbell diagram does not give the complete dynamic behaviour and hence SAFE diagram/Impulse diagram need to be generated. Due to the complex fixity conditions analytical modeling is not very accurate and hence experimental investigation is a must to determine the exact behaviour of the bladed disk. The paper describes the details of telemetry instrumentation used during the test. Detailed analysis procedure has been highlighted to retrieve and interpret the recorded data for generation of SAFE diagram.

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Optimization of GTAW Process Parameters on Mechanical Properties of AA 7075 –T6 Aluminum Alloy Weldments

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ABSTRACT

This works mainly pertains to improvement in the mechanical properties of AA7075-T6 aluminium alloy welds through Gas tungsten arc welding (GTAW) process. Design of experimental technique Taguchi was applied to optimize GTAW process parameters of AA 7075-T6 aluminium alloy welded joints for improving the mechanical properties. Mathematical model was developed by Regression. Adequacy of developed model was checked by Analysis of variance. The effect of heat treat on mechanical properties also studied and observed that there was an improvement in the mechanical properties. Metallography of heat treated and non heat treated welded joints correlated with the mechanical properties.

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Experimental Investigation on the Effectiveness of Active Control Mechanism on Base Pressure at Low Supersonic Mach Numbers

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ABSTRACT

In the current investigation, the experiments were carried out to evaluate the effectiveness of micro jets in controlling the base pressure from a convergent-divergent nozzle at low supersonic Mach at different expansion level. Tests were carried out for low supersonic Mach numbers 1.25, 1.3, 1.48 and 1.6 while nozzle pressure ratio ranging from 3 to 11. The jets are augmented abruptly into an axi-symmetric circular channel with different cross-sectional areas as that of nozzle exit area. The results show that the proficiency of the Micro jets is only marginal in controlling the base pressure even under the influence of favorable pressure gradient at lower NPRs namely 3 and 5. It was also observed that for higher values of the NPRs such as 7, 9 and 11 the dynamic control by very small jets results in rise of base pressure for the different values of the L/D ratios of these investigations. For NPRs 5 and 7 the trend differs due to the level of expansion, nature of waves present in the base region, relief available to the flow, length to diameter ratio of the enlarged duct and the Mach numbers. It is seen that most of the cases exhibit similar behavior for higher as well as the lower length to diameter ratios, which means; that the back pressure has not adversely influenced the flow field in the base region as well as in the duct. With this it can be stated that the micro jets can be an alternative for the experimentalist for base pressure control in the form of micro jets.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

A Review on the Trends and Developments in Hybrid Electric Vehicles

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ABSTRACT

The paper aims at reviewing the history, the development and the current scenario of Hybrid Electric Vehicle (HEV). HEVs has their origin back in the mid-19th century and even though had gone through a lot of ups and downs is today at a revolutionary stage. The excessive usage of fossil fuels and the depleting atmospheric conditions has proven HEVs to be the most viable alternative. This paper goes in detail analyzing the origin of HEVs, their growth and debacle and the current stage of HEVs and the social and economic impact that it can have on the modern world. The paper also draws light on the future technologies that can be implemented in HEVs which can hence make Earth greener. The advancement in the field of Power Electronics and drives and new fast charging and slow discharging, durable batteries have in fact made the HEVs to be more economical and more efficient.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Design of Expert Combustion Monitoring System

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ABSTRACT

It is identified that the monitoring systems can be used, not only for statistics and data processing calculations, but also for combustion, un-burned pollutant components. This situation allows us to realize AFT calculation. It is demonstrated that the AFT equations could be solved efficiently by using Lab view software. The cells in the spreadsheet are viewed as either natural grids or elements of a matrix. The Symphony spreadsheet program is applied to calculate the AFT of Combustion systems. A design template which contains the necessary formulas was constructed so that very little knowledge of the program is required to obtain impressive results. The template becomes a powerful tool by providing a fast and efficient means of designing stable closed-loop system as well as predicting its performance. The computational domain corresponds to the real physical shape and/or the computational space by grid generation. The result can be visualized on the same Lab view with inherent graphics. The pre- and post-processors are all in one in SAFT.

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Structural Performance Analysis of SAE Supra Chassis

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ABSTRACT

The objective of this study is to analyse the design of a Formula SAE roll cage by analytical and numerical methods based on dynamic loads experienced by the roll cage under normal driving conditions. Torsional stiffness of the roll cage has also been studied. Good designs demand a light chassis which has to sustain the racing environment. In this study static and dynamic load distributions were calculated analytically followed by extensive study of various boundary conditions to be applied during Finite Element Analysis (FEA) carried out in Ansys. Stress distributions, lateral displacements during static, dynamic conditions and frequency modes were analysed and a high factor of safety made the design favourable for use.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Numerical Investigation of NACA 0025 & NACA 0021 of Straight Blade Darrieus Turbine for Hydrodynamic Applications

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ABSTRACT

This paper presents CFD analysis carried out to study effect of two NACA blade profiles and various number of blades on coefficient of power on straight blade Darreius turbine (vertical-axis water turbine) for hydrodynamics applications. Results of study are noticed to be in good agreement with published literature. CFD analysis has been carried out using RANS unsteady calculations for three, four and five-bladed rotor configuration of NACA 0025, NACA 0021. Also, characteristics of flow field have been investigated for different values of tip speed ratio, to find out the influence of various blade number and two blade profiles on flow geometric features and dynamic quantities, such as rotor torque and power. The profiles of torque and power have been compared for the three analyzed configurations of NACA 0025 taking as reference and the effect of various blade numbers and two blade profiles on overall rotor performance has been investigated. After that optimise design of straight blade Darreius turbine (vertical-axis water turbine) for hydrodynamics applications has been proposed.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Parametric Optimization of FSAE Restrictor for Random Vibrational Analysis

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ABSTRACT

The Air Intake restrictor of an FSAE car is associated with the fluid flow analysis of the system. Structural integrity of the restrictor plays a major role in the optimization of the system thus obtaining aero-structural interaction. This paper aims at the optimization of the restrictor holistically. Fluid flow conditions are modeled for different convergent and divergent angle of the restrictor using choking condition, the lowest pressure difference model is chosen as the optimum solution. The pressure inside and the environment pressure is coupled to the structural analysis and then to vibrational model. A random vibrational analysis is performed to obtain the Random probability of stresses due to undulations in the road. A 3- stress is considered and Parametric optimization of the random vibration is used optimize the thickness of the restrictor to get best possible thickness.

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Taguchi's Parametric Approach in Optimizing Selective Inhibition Sintering Process Variables

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ABSTRACT

Selective Inhibition Sintering (SIS) is novel additive manufacturing process wherein wide array of indigenous polymers can be used to produce high strength parts. The contemporary approach has many parameters that need to be optimized. The proposed work considers layer thickness, heater speed and amount of heat as candidate options to optimize using Taguchi's single response method. The thermo-structural Finite Element Analysis (FEA) provided the maximum displacement and temperature of the structural model. Design of experiment is conducted for three levels of considered factors and corresponding orthogonal array and responses are obtained.Further, Analysis of Variance (ANOVA)studies are steered to evaluate the influence of these parameters on parts dimensional accuracy. The simulation analysis results of this work demarcated that layer thickness is one of the important factor in SIS process for dimensional stability. Finding from this study enable us to perform experiments on suitable layer thickness that leads to production of parts with adequate strength.

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Design of an Aircraft Wing for Given Flight Conditions and Planform Area

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ABSTRACT

Wing design is crucial in order to get required performance during flight. Wing design includes selection of airfoil, planform shape with a host of parameters like leading edge sweep, thickness to chord ratio and twist. Design of wing for a 20 tonne class combat aircraft, capable of supersonic cruise (M=1.3 at an altitude 6 km) and for short take-off and landing is considered as a test case. A sequential selection method is used in this study as a first step before full DoE based optimization.

NACA 64A series airfoils are used for construction of various wing geometries by var-ying (a) camber 0 % to 5 % (b) leading edge sweepback angle of 42O ± 3O (c) maximum thickness to chord ratio of 4 % and 5 %, and (d) geometric twist angle of about 0O to 1O. CATIA software is used for creating the wing geometry. ANSYS-Fluent software is used for CFD simulations. The plain wing geometry is arrived by sequentially analyzing each geo-metric parameter. Simulations are also performed for wing with high lift devices like leading edge slat and trailing edge flap for take-off and landing condition.

For required flight condition plain wing with airfoil NACA 64A204, 42O leading edge sweepback, -0.53O twist and 0.23O wing incidence angle showed improved aerodynamic per-formance than baseline wing. The selected plain wing with high lift devices of +12.5O deflec-tion at M=0.25 has slightly more lift coefficient and (L/D)max than wings with high lift devices at other deflection and Mach number.

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Investigations on the Influence of Mechanical Behaviour of Copper Aluminium Nickel Powder Compacts Processed Through Powder Metallurgy

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ABSTRACT

Optimization is proved proficiency method, which is used for finding required process conditions to give the maximum or minimum value of the function.A new metal based alloy with a defined composition of Copper (84%) Aluminium (12%) Nickel (4%) is proposed. The powder has synthesised by a powder metallurgy process for the production of near net shaped components through mechanical alloying. It is more complex to attain the properties in making of the materials for marine applications. The main objective of this study was to obtain an alloy compact with high density and hardness and consider a set of optimal process parameters like sintering temperature, holding time and compaction pressure. The alloy has a set of desired properties to suit the needs of the marine applications, porous material filters and electric friction equipments. The combination of Cu-Al-Ni offered in marine applications like rotary hydraulic actuator, hydraulic tube due to high mechanical strength, good corrosion resistance. Copper, Aluminium and Nickel powders are mixed by ball milling equipment and compacted at pressures 550MPa, 590MPa and 630MPa using Universal Testing Machine (UTM). These compact specimens have been sintered in an electric muffle furnace at temperatures 640°C, 695°C and 750°C at different holding times of 30 minutes, 60 minutes and 90 minutes. The L9 orthogonal array was designed with the combination of input factors and their levels. The experiments were conducted at each level to measure the maximum hardness and density. Grey Relational Analysis was applied to find the optimum input parameter configuration. ANOVA was adopted to determine the level of significance of input factors. Confirmatory experiments were done to verify the optimal results.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Investigations on the Performance of Various Bio-Fuels along with Low Thermal Conductivity Piston Crown in a Diesel Engine

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ABSTRACT

In this work, combustion chamber of the engine is modified with a brass piston crown with air gap insulation of 2 mm between the crown and the piston body. After modification; experiments are carried out with bio-fuels like jatropha, karanja and palmoleinon a single cylinder diesel engine with constant speed and an injection timing of 29° bTDC. Comparison of performance parameters, heat balance details and exhaust emissions isdonein case of all the fuels at various loads. Brake thermal efficiency increased appreciably with karanja than diesel, while fuel consumption is more in bio-fuels. Heat utilized for brake power is more with karanja when compared to all other fuels. Heat carried away by exhaust gases remained same for all the fuels for allthe load conditions. Also, heat rejected to the coolant is lowest for karanja. Furthermore, CO and HC emissions are fewer with karanja. Thus, the present work identify karanja as a suitable alternate fuel and with more engine modifications, performance of the engine can be further enhanced.

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Design and Development of FPGA Based MAGLEV System for a Low-Speed Wind Tunnel

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ABSTRACT

The present work seeks to develop a magnetic levitation (MAGLEV) system suitable for a low-speed wind tunnel, to support light weight models using FPGA controller. The concept of Pulse Width Modulation (PWM) was used to control single degree of freedom. The reference voltage set and the differential voltage from linear Hall Effect sensors (SS 494B) are compared. The duty cycle varies from 0% to 100% based on the position of the object. These sensor outputs were connected to NI 9239 and the output (PWM) was obtained from NI 9472. This output was given to the driver circuit to achieve appropriate action. A MOSFET was used to boost the current, required for levitation. A diode was connected in parallel with the electromagnet to avoid reverse current flow. A LabVIEW FPGA program was built in order to generate PWM and finally levitate the object. FPGA based control is event based control and provides microsecond delay

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Performance Investigation of High Temperature Combustion Technology (HiCOT) using CFD Simulation

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ABSTRACT

Combustion is the process of converting the energy stored in chemical bonds to heat energy that can be utilized in a various ways. A good engine is a one which has high efficiency that leads to high performance of the aircraft. In this fast emerging field, fuel exhaust emission has become a hazardous thing to be considered by all leading industries. According to the International Statistics, both the developed and developing countries are contributing their efforts to important emission of greenhouse gases. In-order to improve the efficiency of the combustion process, energy conservation, reduces the global oil crises and the emission of harmful gases, HiCOT would be a better technology to produce favorable results. High temperature Combustion Technology (HiCOT) is a promising technology for energy saving, flame stability enhancement and NOx emission reduction. In a conventional HiCOT system, the combustion air is highly preheated by using the recuperative or regenerative heat exchangers. In this project the combustion air is heated using the recirculation process. Numerical studies have been carried out to investigate the combustion performance of methane-air mixture in a cylindrical combustor using High Temperature Combustion Technology (HiCOT) to predict thermal efficiency and pollutant emission levels of NOX and CO2 at various air inlet temperatures and velocities using CFD simulation. The design process is carried out through ANSYS-Design Modular. Flow domain, Grid generation, CFD simulation and the Post-processing results are obtained using ANSYS Workbench and Fluent.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Calculation of Theoretical Performance of Boron-Based Composite Solid Propellant for the Future Applications

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ABSTRACT

Elemental boron is a highly attractive high energy material and it is a metalloid chemical element. Boron possesses the second greatest heating value of any element that can be adopted as an energetic material in the processing of propellants and explosives. In the present work, boron based composite solid propellants are examined theoretically. In the actual condition, boron has problems during the ignition and combustion due to the coating of B_2O_3 layer on its surface. The vacuum specific impulse and the specific impulse are calculated for several boron based propellants with the help of NASA Lewis Code, Chemical Equilibrium with Applications (CEA). Several other elements such as aluminium, iron, magnesium and titanium are also considered in this study as additives in boron based propellants. The performance values of boron-based propellants are compared with that of pure aluminium based composite propellant. In the CEA simulation hydroxyl terminated polybutadiene (HTPB) and ammonium perchlorate (AP) are taken as binder and oxidizer respectively. Although, pure boron-HTPB-AP has the highest theoretical performance, it is observed that presence of any small percentage of boron in aluminized propellant can give higher performance than that of pure aluminium based propellant.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

PreSTo Wing Module Optimization for the Double Trapezoidal Wing

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ABSTRACT

This paper explains the Aircraft Preliminary Sizing Tool (PreSTo) developed at the Hamburg University of Applied Sciences. From the different modules of PreSTo, PreSTo wing and its sweep angle have been taken as the key feature to explain further. In order to figure out the necessary values for the double trapezoidal wing a loop has been created between the kink chord, inner taper ratio, inboard leading edge sweep angle, and inboard 25% chord sweep angle. By the end of the loop all the major chords, sweep angles and taper ratios are calculated and a 2D representation of the wing is given. PreSTo will interact with the user by giving suggestions and during certain parameter conflicts; it can give warning to the user concerning his previous made design choices. Values of wing parameters generated in the wing module are finally stored into PreSTo central database. OpenVSP Connect retrieves values from PreSTo central database and visualizes the aircraft and its wing in 3D with NASA's tool Open Vehicle Sketch Pad (OpenVSP).

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Optimization Technique Applied for Method of Evaluation of a Controllable Factor of Chassis of FSAE CAR

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ABSTRACT

Design of any system is imperfect without optimization. The common problem faced for any design engineer during designing of a tubular race car chassis is the determination of optimum parameter for the tube. This optimization technique is specifically applied to the chassis of FSAE car. This technique provides the most optimum equation which relates all the controllable factors of the chassis. The optimum equation is found using point- set topology, surface fitting methods, iterations in analysis softwares. Controllable factors like diameter, wall thickness, deflection, yield strength are made a 3D surface function in the form of $z=(ax^n)(y^m)+(bx^{n-1})(y^m)+(cx^n)(y^{m-1})+....px+cy$. The obtained equation is the most optimum equation which relates all the controllable factors for a specific loading condition. Considering loading condition as side impact condition, if the optimum parameter has to be chosen (say diameter), the priority of deflection and the yield strength of the material is input into the equation, which contains the deflection and yield strength as other parameters. The equation is solved to obtain the most optimum diameter for the specified inputs. If all the inputs are given to the Equation and if the equation is satisfied, the given inputs are said to be optimum inputs (Zero deviation from the given equation). Any variation either below or above the equation are considered to be positive or negative deviation measured from a reference of the optimum equation.

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Multi-Objective Optimization of EDM Process Parameters using PCA and TOPSIS Method during the Machining of Al- 20%SiC_p Metal Matrix Composite

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ABSTRACT

The present experimental study deals with the machining of Al-SiC_p metal matrix composite (MMC) (with 20% SiC reinforcement) by using a brass tool electrode using electric discharge machining (EDM) process. The aim of the present work is to analyze the effect of input parameters such as input current (I_p), pulse on time (T_{on}), duty cycle (DC) and gap voltage (V_g) on the response variables material removal rate (MRR), tool wear rate (TWR), diametral overcut (DOC) and surface roughness (SR). The experiments were performed using Taguchi's L_9 orthogonal array. Multi-objective optimization has been applied using a hybrid approach by combining principal component analysis (PCA) and technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to obtain maximum MRR and minimum TWR, DOC and SR.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Study of Static Stall Characteristics of a NACA 0012 Aerofoil using Turbulence Modeling

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ABSTRACT

Static stall of a NACA 0012 aerofoil has been studied by simulating a two dimensional, incompressible flow over the aerofoil section at various angles of attack for a Reynold's No. of three million. An *SST k-*turbulence model is used to capture the turbulence, flow separation and associated pressure changes. The lift coefficient is plotted with the angle of attack to determine the stall angle and the results are compared with experimental results. The computation is done on a structured mesh comprising of 57,344 cells (with refined regions near the aerofoil and extending till the edge of the domain for the part above and below its front of to capture the boundary layer and turbulence over the aerofoil) by solving the steady state momentum and continuity equations along with the two equations of the *SST k-* turbulence model. The angle of attack is varied by changing the flow direction of air; no changes are made to the air speed. This study shows that modelling turbulence with the *SST k-*model can yield an estimate of the stall angle of aerofoils at high Reynold's Number flows.

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Effect of Compaction Aspect Ratio on Wear Characteristics of Sinaqter Extruded Pure Copper Processed through Powder Metallurgy Route

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ABSTRACT

Powder Metallurgy is widely used unique manufacturing process resulting in a near-net shape. The parameters like, the compaction pressure, aspect ratio (height to diameter ratio), sintering conditions can be varied in order to achieve the required properties of the end product. In this research work, all the above parameters except the aspect ratio are fixed. Wear analysis is carried out on sinter-extruded Copper samples made for two different aspect ratios, 0.5 and 1. The experiments are conducted based on Taguchi's L18 orthogonal array by taking the aspect ratio, speed and load as the three important factors. The mass loss and COF (co-efficient of friction) are the main results studied in this work and are supported by hardness and density measurements.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Evaluation of Tensile Properties of Natural Silk and Coir Fibers

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ABSTRACT

Natural fibers have attracted tremendous attention for improving the toughness of composites through hybridization. As a step forward in this, the current paper present a systematic study on the evaluation and comparison of tensile behaviour of naturally available BM silkworm silk and coir fibers as well as synthetic carbon fibers. Tensile experiments are conducted to estimate the statistical strength properties for all the fibers over a variation of lengths ranging from 10 to 30 mm, wherein the effect of machine compliance is also taken into account. Fracture statistics are correlated with the effects of gauge length, and the Weibull modulus is calculated using strength distribution method as well as gauge length method. The tensile strength and modulus of silk fiber is 6 and 2 times, respectively, higher than that of coir fiber. The failure strain of both the fibers is comparable having high value in the range of 15-20%. Among the three fibers, coir fiber showed better reproducibility of properties with respect to gauge lengths indicating very little variation of flaws with fiber size. The results are promising for application of silk and coir fibers as reinforcements in hybrid composites.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Comparison of Turbulence Models in Simulating Axisymmetric Jet Flow

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ABSTRACT

The present work is a comparison of various turbulence models available in ANSYS-Fluent in simulating an axisymmetric jet flow. A large domain is chosen for simulation of the jet flow with an intention to avoid errors due to the computational boundaries. The simulations are carried out at a fixed Reynolds number for facilitating comparisons. This work considers various first order closure models like standard k-epsilon model, standard k-omega model, RNG k-epsilon, Realizable variants of k-epsilon model, SST k-omega model and a second order closure model namely Reynolds stress model. The simulated results are compared with reference literature to understand the applicability of models using various parameters like inverse mean axial velocity decay, turbulence intensity, turbulent kinetic energy and streamlines. Large variations are found in all the parameters between first and second order turbulence closure models. The streamlines also show reverse flow patterns near the nozzle for second order turbulence model. The first order closure models are found to be better than the second order closure models in predicting the flow field of axisymmetric jets.

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Finite Element Analysis of High Strength Polymers Interaction with Inhibitors in Selective Inhibition Sintering Process

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ABSTRACT

Selective Inhibition of Sintering (SIS) is a predominant Additive Layer Manufacturing (ALM) technique to produce parts out of polymers and metals. The present work considers sintering interaction phenomenon between high strength polymers and inhibitors using Finite Element Analysis (FEA). Transient thermal coupled with structural analysis is performed for various high strength polymers such as Polyamideimide (PAI), Polyetherimide (PEI), Polyphthalamide (PPA) and Poly Tetra Fluoro Ethylene (PTFE) with inhibitors Potassium iodide (KI), Potassium chloride (KCl) and Sodium chloride (NaCl). Simulation results suggested that the effect of heat is more influencing on PAI which obtained minimal structural displacement in comparison with other polymers. Compared with NaCl, the inhibitors KCl and KI provided greater inhibition effect which will be employed in SIS additive manufacturing process to manufacture high strength and dimensionally stable plastic parts.

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Optimization of Process Parameters of Powder Additive Mixed Electrical Discharge Machining by ANOVA Method

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ABSTRACT

The objective of this paper is to investigate the optimum process parameters for a particular work piece and tool electrode combination on Powder Additive mixed Electrical Discharge Machine. In this experiment, three levels of current, powder concentration and pulse ON time are kept as the main variables. The work piece material was taken as EN-19 and tool material kept constant at various levels of the performance. The DOE tool software is used to design the PMEDM experiments. The various tools of DOE are used to analyze the final results of the experiment with the help of Minitab-17 software. The analysis of variance (ANOVA) is also performed to identify the statistical significance of parameters. The result of the experiments are the optimum values of MRR (material removal rate), TWR (tool wear ratio), and Over cut with the help of ANOVA. The conclusions arrived for optimum values of different parameters are discussed at the end.

SOUVENIR — 2nd International Conference on Innovative Design, Analysis & Development Practices in Aerospace and Automotive Engineering (I-DAD 2016).
Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Amphibious Design and Verification of River Crossing Capability of Armored Personal Carrier using CFD and Model Testing

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ABSTRACT

The Armoured Personnel Carrier is basically used to transport the crew i.e. persons with ammunition (infantry) the battlefield. As the vehicle is either may be wheeled or tracked. Amphibious capability of such a vehicle is very much necessary because sometimes it has to cross river or canal while reaching to the battlefield.

Crossing of the river with much of its side exposed to the water current rather than its front is one of the worst-case amphibious conditions wherein the vehicle experiences entirely a different pattern of drag and stability boundary constraints. Here, an attempt has been made to analyse the river crossing ability of an 8x8, wheeled, Armoured Personnel carrier through CFD analysis and model testing techniques. A new testing technique was employed for simulating the river crossing of the vehicle in towing tank. A $1/5^{th}$ scaled model of the vehicle was fabricated and tested at different heading angles in the towing tank. Adequate details on the stability and dynamics of the vehicle in the water and the side force experienced by the vehicle have been captured and analysed. Flow pattern obtained from CFD analysis and model testing has been compared and analysed.

SOUVENIR — 2nd International Conference on Innovative Design, Analysis & Development Practices in Aerospace and Automotive Engineering (I-DAD 2016).
Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

A Spring-Activated Quick-Response Mechanism for Legs of a Mooring Mast: Conceptual Design and Analysis

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ABSTRACT

A Mooring mast is used for safe and secure ground-handling of airships. It occupies space, and hence there is a need to make it foldable and easily portable. The mast is provided with long legs to have adequate ground-stability; hence it is important for the legs to be quickly foldable. This paper describes a mechanism designed to enable quick unlocking and folding as well as quick unfolding and locking of the legs, in an appropriate orientation. The mechanism employs a spring-activated quick-response rod. Kinematic analysis of the mechanism and stress-analysis of its key components have also been carried out.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Aluminum Agglomerate Size Measurements in Composite Propellant Combustion

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ABSTRACT

An experimental and numerical investigation has been done to evaluate the aluminum agglomerate size in AP/HTPB/Aluminum propellants and compared it with burning rate results. Bimodal AP particle size distribution is considered in the present work. The effect of aluminum size, aluminum content, fine AP size, fine AP/binder ratio and coarse AP size in aluminum ignition, accumulation and agglomerate formation during combustion, typically in their ranges, are focused. The burning rates were found to be higher for the propellants with lower fine AP/binder ratio. The agglomerate sizes for the propellants with 10 % Al was found to be higher than those with 15 % and 18 % aluminum. Observing the agglomerate sizes and the burning rate trends, it can be concluded that the agglomerate sizes vary inversely as the burning rates.

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Handling Simulation and Experimentation of an Armoured Multi-Axle Vehicle with Multi-Axle Steering

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ABSTRACT

Vehicle handling is studied by first quantifying the steady-state behaviour of vehicles and then relating steady-state principles to transient dynamics. A multi-axle vehicle is believed to have better performance than a two-axle vehicle in terms of its capability of obstacle navigation, off-road and on-road manoeuvrability. In this study, a comprehensive multi-body model of the vehicle with multi-axle steering was developed. The handling characteristics of a vehicle are affected by vehicle weight and its distribution, road surface conditions, tire characteristics, suspension properties and steering angle. A MBD model for handling was developed and steer angle versus lateral acceleration was plotted. Handling characteristics of a multi-axle vehicle were carried out objectively as per SAE test procedure and the model was validated through conduct of actual experiments. It was concluded that under steer characteristics as desired were achieved.

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Analysis of Air to Air Rotary Regenerator for HVAC Systems using CFD

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ABSTRACT

Air to air heat exchangers play a crucial role in mechanical equipment, due to potential primary energy savings both, in the case of commercial properties and economic zones. This paper studies computational fluid dynamics (CFD) simulation in a rotary regenerator achieving a capacity of 90 ton by heating ventilation air conditioning systems The modelling is done using the commercial code ANSYS FLUENT ©. The operating parameters like rotational speed, porosity of mesh and dimensions of rotary regenerator like length, diameter were studied and compared with literature. Effects of variation of pressure, velocity and temperature at different sections of the rotary regenerator which accounts for the effectiveness of rotary regenerator and the percentage increase in coefficient of Performance (COP) of HVAC plant are discussed.

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Design & Optimization of a Steering Knuckle of FSAE Car

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ABSTRACT

Steering Knuckle is that component of a vehicle which connects the suspension system, braking system and the steering system to the chassis of the vehicle. A steering knuckle should have high precision, durability and low weight. The purpose of this study is to design a knuckle which is low in weight and has better performance with considerable factor of safety. The study is divided into two steps. The first step involves the designing of a steering knuckle with the help of a designing software and estimating the loads acting on the component. The second part is carrying out FEA on the component to find out the stresses induced and the deformation. This will help in optimizing the knuckle. After the analysis has been done, the knuckle can be optimized by removal of materials where the induced stress is low.

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CFD Analysis of Flapping Wing for MICAV Application

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ABSTRACT

CFD Analysis of Flapping wing is required for the design of MICAV configuration. The basic aerodynamic phenomenon for MICAV flapping wing flight is unsteady flow, spiraling leading edge vortex formation which is responsible for sustained flight at low speeds, wake capturing which adds additional lift and fast pitch up which generates positive lift at the time of stroke reversal. In this paper an investigation has been done for a typical MICAV flapping wing configuration. Wing is subjected to sinusoidal flapping oscillations with a frequency 25 Hz, amplitude of 45 deg upstroke and 35 deg down stroke; span of the wing, 45 cm; chord, 15cm; thickness varied from 00251mm to 0.1mm; leading edge is straight and trailing edge is curved. CFD unsteady solution is obtained and analyzed. It has been found that 0.025mm thick wing tend to generate more lift and thrust than 0.1mm thick wing.

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GA Based Multi-Objective Optimal Control of Nonlinear Quarter Car Suspension

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ABSTRACT

Multi-objective optimization of optimal control of quarter car suspension system is presented in this paper. A quarter car having quadratic stiffness of tyre and cubic stiffness of suspension stiffness is modeled for control application. In optimization, the variables, weight matrices parameters are searched to satisfy objectives viz. RMS sprung mass acceleration, RMS control force, RMS suspension/rattle space, tyre deflection and unsprung mass displacement and constraints on RMS acceleration and maximum control force. As the nature of the problem is of multi-objective type and objectives are of conflicting nature, hence GA is implemented to search the weight matrices parameters. During optimization and simulation acr is travelling on class E road at 80 kmph. Trade-off front is obtained from optimization and three cases I, II and III are selected and simulated further upto 120 kmph. These three cases provides ride comfort by keeping RMS sprung mass acceleration below ISO 2631 limit i.e. 0.315 m/s2. Amongst the three cases designer may prefer CAse II as it follows all constraints upto 120 kmph.

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Study of the Influence of the Process Variables on Formability and Strain Distribution in Incremental Sheet Metal Working of AA 1050 Sheets

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ABSTRACT

Incremental sheet metal forming is a novel and quick process suitable for rapid prototyping and production of small batch of sheet metal components. The forming operation is carried out at room temperature employing a CNC machining centre. A specially designed spherical tip tool and a simple support to hold the formed sheet are required to undertake the process. In this work, incremental sheet metal forming was carried out on 0.5mm AA 1050 sheet to study the impact of process and product characteristics. The process parameters involved are rotation of the tool, feed in x, y directions and axial feed in z direction. Two process conditions are used namely with lubrication and without lubrication. Frustum of square pyramid has been considered as the shape of the component form the formed component strain distribution was measured. To measure strain distribution, circular grids were etched on the surface. Formability diagram were plotted with the results. The results of forming with lubrication and without lubrication were compared and brought out.

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Operating Characteristics of Multi Cylinder Petrol Engine using LPG with Methanol

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ABSTRACT

Increase in environmental pollution, energy scarcity, depletion of fossil fuels and to secure future fuel supply, the need of non petroleum based alternative fuels becomes essential. These alternative fuels are used to increase the efficiency and reduce adverse effect of green house gases. Owing to high octane rating, Liquified Petrolium Gas proves to be more efficient than petrol mixed with methanol up to 2 ml/min. which is used as an alternative fuel in this study. This alternative fuel can be used in the S.I. engine with slight modification in the fuel supply system. The experiments are conducted in 4-cylinder, 4-stroke petrol engine with bi-fuel activated by the solenoid. The actuator diverts LPG through the vaporizer kit to the carburetor. The flow rate of LPG is calculated using suspended weighing scale. Liquid methanol enhances the LPG prior to the vaporizer kit due to gravity. The vaporizer kit is heated by engine hot water which results in temperature raise in LPG vapour thereby methanol gets evaporated. The petrol engine is initiated by LPG and run by a mixture of LPG and methanol by reducing the LPG flow. The operating characteristics of engine are investigated with varying the quantity of methanol and LPG. The thermal and mechanical efficiencies are found to be increasing with the addition of methanol, whereas the specific fuel consumption and the emission characteristics such as CO, CO_2, HC and NO_x are reduced.

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Advances in Light Weighting Materials for Body-in-White (BIW)

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ABSTRACT

Conventional metallic materials are getting replaced by lightweight materials in the last two decades for body-in-white (BiW) structural components for all types of vehicles from two wheelers to heavy commercial trucks and passenger buses. The main driving forces are depleting fuel resources leading to the fuel economy standards, safety & crashworthiness legislations, emission regulations, green environment requirements leading to control CO_2 and other toxic gas emissions, recyclability, etc. The auto industry sees developments of light weight steels to aluminium & magnesium alloy, to fiber-reinforced plastics (FRP) emerging to make lighter vehicles. The other influencing factors for light weighting materials technology are customer driven requirements like styling, aesthetic appearance, reduced NVH (noise, vibration & harshness) aspects and comforts. The future vehicle technology is moving ahead with developments of lithium batteries for electric & hybrid cars & buses, Solar cell and hydrogen driven fuel systems. These technologies also need light weighting vehicles to use these additional gadgets on the vehicle.

Variety of options is available in the market, but lightweight materials play a vital role in vehicle design for tomorrow. In India, the light weighting materials technology has yet to make a great impact and considering 'make in India', the article is focused on challenges and opportunities that need to be addressed soon.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Health Monitoring for Armoured Fighting Vehicles

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ABSTRACT

Health Monitoring of Armoured Fighting Vehicles (AFVs) focuses on data collection using various sensors and analysis techniques to ensure availability, reliability and safety of AFVs. There are two types of Health Monitoring system, to be precise Prognostic Health Monitoring System and Diagnostic Health Monitoring System. This paper describes the Diagnostic Health Monitoring system used for the Powerpack of Armoured Fighting Vehicles with a case study on Integrated Automotive Vetronics System.

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Orbital Parameters Variations of IRNSS Satellites

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ABSTRACT

IRNSS is one of the unique constellations first of its type dedicated for providing the satellite based navigation in Indian subcontinent. The IRNSS constellation consists of seven satellites with three satellites in GEO orbit with inclination of 5^0 and four satellites in GSO orbits with inclination of 29^0. The constellation is designed to get better satellite geometry in terms of Dilution of precision (DOP) over Indian region and its extended area. All satellites in the constellation provide 24 hours visibility within and across geographic boundaries of Indian land mass with minimum elevation greater than 15^0.

This paper presents the variations of Keplerian elements of all four operational satellites of IRNSS Constellation. The satellite state vector, satellite clock and receiver clock parameters are estimated using consolidated orbit determination algorithm of Navigation software installed at ISRO Navigation Center. The estimated state vectors are converted into the Keplerian elements. The variations in the Keplerian elements show the expected behavior showing the influences of natural perturbations like J2 effect, luni-solar perturbations etc.

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Cabin Control System on Temperature Impact using Occupant Detection Scheme for M1 Category Vehicles

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ABSTRACT

Temperature influence on parked vehicles in hot climatic conditions is dangerously high and the impact on the occupant is directly felt leading to catastrophic disaster, even loss of lives. Every year hundreds of lives are lost inside the locked vehicle cabin. The cabin safety is ensured by the autonomous door locking system in the vehicle's movement and in parked state depending on the input of the driver and its autonomous nature. The tendency of the occupant within the vehicle depends on the state of vehicle's idling nature and the driver leaving the vehicle in parked state.The automatic door locking system is synchronized with the inputs from the driver control switch, the wheel speed sensor and the engine rpm. The temperature influence in the parked vehicle conditions towards the occupant is tremendous. A maximum of 80°C can reach within the cabin in parked state of the vehicle. The impact of heat is competitive and the suffocation rate is high. The safety of the occupant within the vehicle is the major concern. The system aims at protecting the safety of the occupant (most supposedly the child occupant) by the detection of weight as the major concern by the testing standards of AIS-008. The system ultimately aims at reducing the casualty rate and protecting the occupant by measuring the weight of the occupant and the cabin temperature and controls the windows to be lowered to reduce the level of suffocation. Fresh air circulation is made to be in the cabin and the occupant safety is ensured.

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Comparative Approach Towards Modified Smith Predictor and Back Calculation Design for Conical Tank Level Process Control

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ABSTRACT

The objective of this paper is to show the energy utilization of actuator and its performance in nonlinear process. Objective includes design and comparison of modified smith predictor, modified back calculation methods and conventional PI controller for conical tank level process (FOPDT). The design comprises of mathematical modeling of conical tank using two-point method, controller tuning and architecture of the process.In FOPDT models integral term influences the actuator to react beyond its limits which results with windup phenomena in the process. This can be controlled by limiting integral term with respect to actuator requirements. Whole experimentation is classified into three operating regionsand for all the methods mentioned in the paper. Based on operating region the methods has their own significance in performance. The design approach has been validated through the real time results.

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A Study of Effect of Piston Bowl Shape on Engine Performance and Emission Characteristics of a Diesel Engine

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ABSTRACT

This paper presents a study on the effect of re-entrant piston bowl configuration on the emissions characteristics and engine performances of a direct injection (DI) diesel engine. In order to meet the emission norms, modern day diesel engines rely on methods of in-cylinder emission reduction and expensive after treatment device. By using an effective piston bowl shape one can reduce the in-cylinder emission and the cost increased for the after treatment device with considerable increase in the engine lifetime. Six piston bowl shapes with various geometric configurations were selected for numerical simulations. Three-dimensional models of the piston bowl shapes and the combustion chamber were created using Pro-E and mesh was generated by using pre-processor ANSYS-ICEM CFD. The flow characteristics inside the cylinder with these piston bowls were investigated under steady condition with the RNG k-ε turbulent model using ANSYS-Fluent. Numerical simulations under isothermal condition were carried out to select an optimum bowl shape. The mass-flow boundary condition was used for inlet manifold and the value of this was measured from the experimental test. The CFD results of mean swirl velocity of the engine at different locations in inside the combustion chamber were calculated. From the computational results, it was found that the average swirl number is increased from 0.87 (base shape) to 1.74 (modified bowl shape). It is well known that the swirl number is very important to enhance the homogeneity of air/fuel mixture inside the combustion chamber, which in turn improves the combustion efficiency. The experimental results shows that, as compared to the baseline engine 20% reduced in hydrocarbons (HC) emissions and 24% reduced in carbon monoxide (CO) for the engine with modified piston bowl shape. However, there is a small amount of reduction in engine performance. It is observed that the brake specific fuel consumption (BSFC) reduced significantly for all load conditions.

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Vel Tech Dr. RR & Dr.SR Technical University, Chennai, India. 22nd – 24th February 2016.

Investigation of a Novel Turboprop Driven Aircraft Concept Including Future Technologies

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ABSTRACT

This paper presents a novel concept for a highly efficient and ecological propeller driven aircraft. The aircraft has a high wing, T-tail and two turboprop engines with large propeller diameters decreasing disc loading and therefore increasing propeller efficiency. The aircraft also features a strut braced wing with natural laminar flow. It is shown that direct operating costs can potentially be reduced by about 17 % while reducing trip fuel mass and therefore CO_2 emissions by about 36 % compared to the reference aircraft Airbus A320.

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