Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

DEPARTMENT OF MECHANICAL ENGINEERING

PRESENTS

VULCAN

(2018-2019)

"Vulcan is the Roman and Greek god of fire and the forge, and mythical inventor of smithing and metal working"

IN ASSOCIATION WITH

MESA
MECHANICAL ENGINEERING
STUDENTS ASSOCIATION

Department of Mechanical Engineering

Vision

To be a Centre of Excellence for education and research in the field of Mechanical Engineering to meet the national as well as global challenges.

Mission

M1: To educate and enrich effective and responsible engineers for national as well as global requirements by providing quality education.
M2: To maintain vital State-of-the-Art Research facilities to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.
M3: To develop linkages with world-class organizations and educational institutions in India and abroad for excellence in teaching, industry and research.
M4: To cultivate and promote entrepreneurship using the industry and R&D facilities of the institution.

Program Educational Objectives (PEOs)

PEO1: Apply modern analytical, computational, simulation tools and techniques on engineering materials, thermal sciences, applied mechanics and manufacturing methods to address the global challenges faced in mechanical and allied engineering streams.
PEO2: Adapt new and recent techniques of engineering science and their applications to conceive, organize and develop the design of engineering systems.
PEO3: Work as an individual and in teams on multidisciplinary assignments in industries, research organizations and academic institutions both at national and global levels through collaboration.
PEO4: Demonstrate techno-commercial skills such as research interest and entrepreneurial ability in students to cater the societal problems.

Program Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

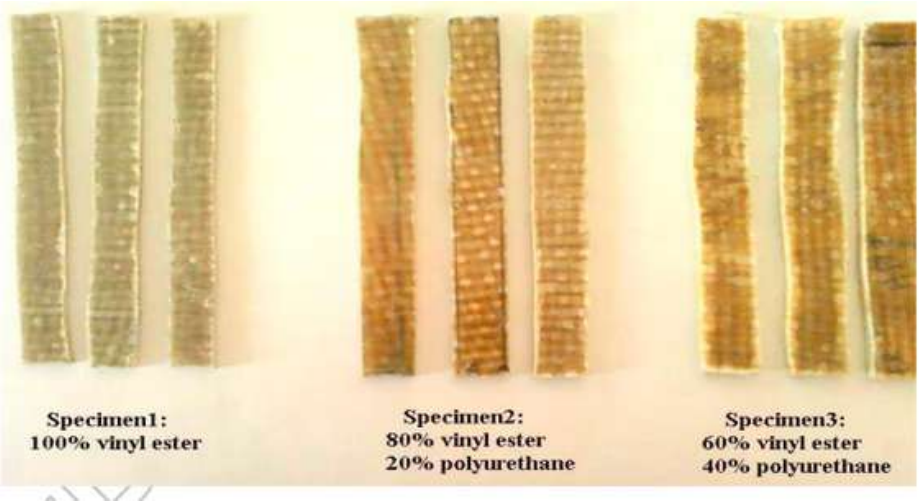
Program Specific Outcomes (POs)

PSO1: Apply their knowledge in the domains of design, manufacturing and thermal sciences to solve engineering problems using advanced technology.

PSO2: Engage professionally in industries or as entrepreneurs by applying innovative ideas in design and manufacturing using modern CAD/CAE/CAM tools.

Evaluation of vibration damping behavior of different sizes of waste tyre rubber in natural rubber composites

In this paper the examination intended to create polymer matrix composites with polyester and vinyl ester better warmth opposition. The glass fiber with polyester favoured with various piece of composite with expansion of various fillers in various weight parts was created. Created utilizing vacuum sack shaping procedure. The mechanical properties were assessed utilizing Universal testing machine and the warmth mutilation temperature is the temperature at which a polymer or plastic example disfigures under a predetermined load. This property of a given plastic material is connected in numerous parts of mechanical assembly with various loads. Better mechanical properties and wear properties were gotten with increment in weight level of auxiliary fortification substance. The Heat Distortion Temperature is controlled by the test strategy delineated in ASTM D648.Further it was discovered that The extent 40:60 and 20:80 does not framed as flawless IPN consequently it is discovered that 80% vinyl ester and 20%poyurethane have great flexibility and sturdiness in correlation with different proportions.



K.Karthik
Mechanical Department

Effect of di-ethyl-ether on biodiesel fuelled diesel engine

This work investigates the impact of diethyl ether as an effective cetane improver on exhaust emission on biodiesel fuelled diesel engine. Transesterification process has followed to yield Mustard oil methyl ester (MOME) from raw Mustard oil using sodium hydroxide as a catalyst. Test fuels used are Diesel, Mustard oil methyl ester (BD100), 10, 20% of Di-ethyl Ether (BD90DEE10, BD80DEE20) incorporated MOME respectively. This work was carried out in a single cylinder four stroke diesel engine. Results showed that by the addition of DEE with biodiesel shows considerable reduction Carbon dioxide (CO), Hydrocarbon(HC), Smoke emission.

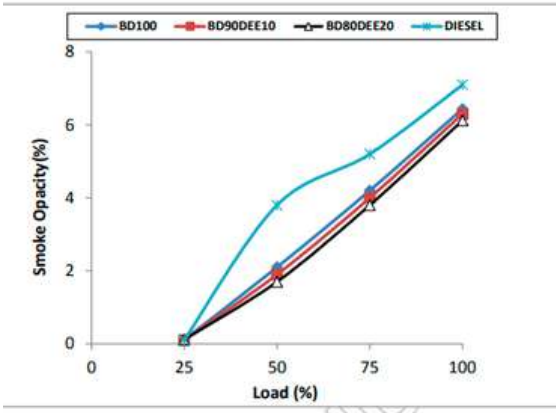


Figure 4. Variation of Smoke

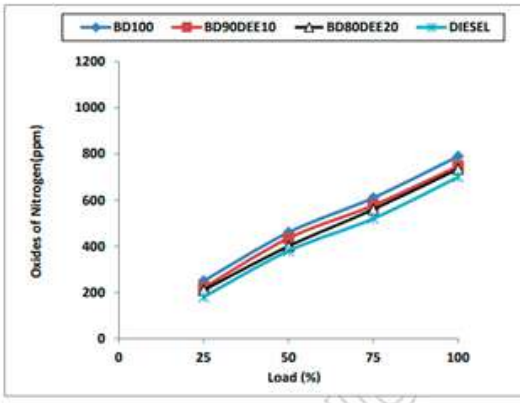
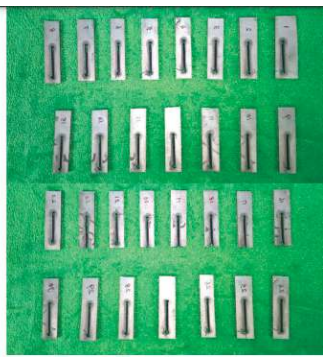


Figure 5. Variation of NO_X emissions

A Devaraj, Yuvarajan Devarajan & I Vinoth Kanna
Mechanical Department

Experimental investigation and optimization of PAC parameters on Monel 400™ superalloy

Nickel-based superalloys are predominantly used to manufacture marine, automotive, and aerospace parts due to its excellent corrosion resistance in acidic environments and high-strength characteristics. Machining of these alloys are extremely difficult through conventional process because of their tendency to quickly work harden and poor thermal conductivity. Plasma arc cutting (PAC) is a disruptive metal-cutting process to perform cutting of difficult to cut materials even for intricate profiles. The present work examines the effect of PAC process variables such as arc current, gas pressure, cutting speed, and stand-off distance on evaluating the surface roughness, kerf width, and micro hardness of Monel 400™ superalloy. Experiments are designed and conducted using Box–Behnken design (BBD) of response surface methodology. The quadratic models are developed and assessed for its performance using analysis of variance (ANOVA). Optimal machining process conditions, cutting speed of 2427.08 mm/min, gas pressure of 3.83 bar, arc current of 45 A, and stand-off distance of 2.14 mm are obtained through multiobjective desirability approach. From the confirmation experiments, the relative error is found to be 2.68% for surface roughness, 4.45% for kerf width, and 4.36% for micro hardness which confirms the feasibility and efficiency of proposed methodology



Rajamani, D.; Balasubramanian E
Mechanical Department

Analysis of emission reduction in ethyne-biodiesel-aspirated diesel engine

The present experimental work investigates the use of ethyne gas in biodiesel-fueled diesel engine at different flow rate of 1, 2, and 3 L/min and is compared with diesel operation. This work is aimed to examine the outcome of ethyne gas by dual-fuel operation on emission characteristics of neat biodieselfueled stationary diesel engine. The oil derived from mustard seeds are employed as a source for biodiesel. The work was carried out at 2100 rpm (speed) and at an optimal compression ratio of 17. Based on the outcome of this investigation, the maximum reduction in hydrocarbon (25.1%), carbon monoxide (17.24%), and smoke emission (24.8%) was observed for biodiesel–ethyne at 3 L/min than the neat biodiesel. However, NOx emissions were found to be 15.8% higher for ethyne–biodiesel fueling at 3 L/min owing to increase in combustion gas temperature than neat biodiesel.

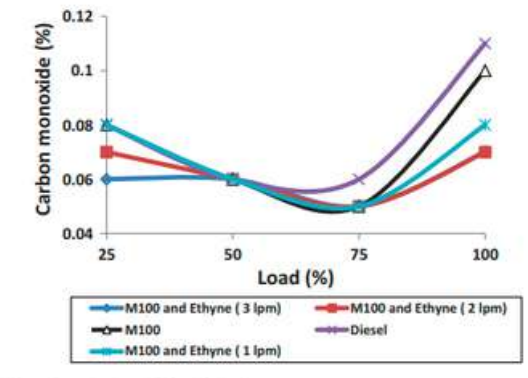
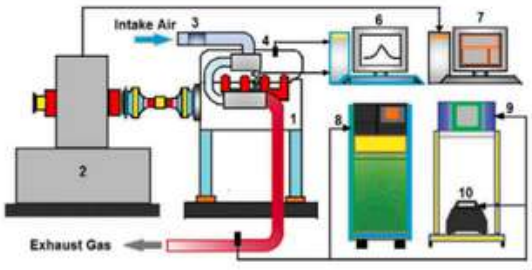


Figure 2. Variation of CO with load.



1. Test engine
2. Eddy current dynamometer
3. Air mass sensor
4. Pressure sensor
5. Accelerometer
6. Data aquisition system (DAS)
7. Dynamometer controller
8. Bosch gas analyser
9. AVL digas analyser
10. Smoke opacity meter

Yuvarajan Devarajan
Mechanical Department

Energy and Exergy Analysis of Multi-Temperature PCMs Employed in a Latent Heat Storage System and Parabolic Trough Collector

This study represents the exergy analysis of the evacuated tube parabolic trough collector and the cascaded latent heat storage system using multi-temperature phase change material (PCMs) during the charging process. The objective of the work is to control the losses and increase the efficiency of the system. The exergy analysis has been conducted on the basis of the first and second laws of thermodynamics in a parabolic trough collector with various mass flow rates of the heat transfer fluid (HTF). The overall variation of exergy efficiency of the collector with varying mass flow rate of the HTF is 5.9 %. The thermodynamic analysis of the cascaded latent heat storage system has been done during the charging process in which the PCM absorbs energy from the HTF and undergoes a phase transformation from the solid to the liquid state. The exergy analysis is conducted by varying the mass flow rate of the HTF in the storage system for both insulated and noninsulated systems. It is noticed that the variation of exergy stored for 5 and 10 liters per minute is 24.609 kW and 40.48 kW, respectively. It is concluded that the high range of energy and exergy stored in the system is achieved by the high flow rate of the HTF.

Yuvarajan Devarajan
Mechanical Department

Selection of optimal glazing material for solar thermal applications using grey relational analysis

This article deals the selection of optimal glazing materials for solar thermal applications with multiple performance characteristics among the twelve alternatives using the Taguchi's grey relational analysis approach. The processing parameters thermal properties, mechanical properties, optical properties, environmental and economic conditions are optimised with multi-response characteristics, including density, thermal conductivity, specific heat capacity, the coefficient of thermal expansion, notch impact strength, tensile strength, refractive index, transmittance, cost, and environment. In this investigation, twelve alternative materials and ten criteria used for material selection for the optimal design. The outcomes revealed that crystal glass has the highest grey grade of 0.588, which is the optimal glazing material among the twelve alternatives.

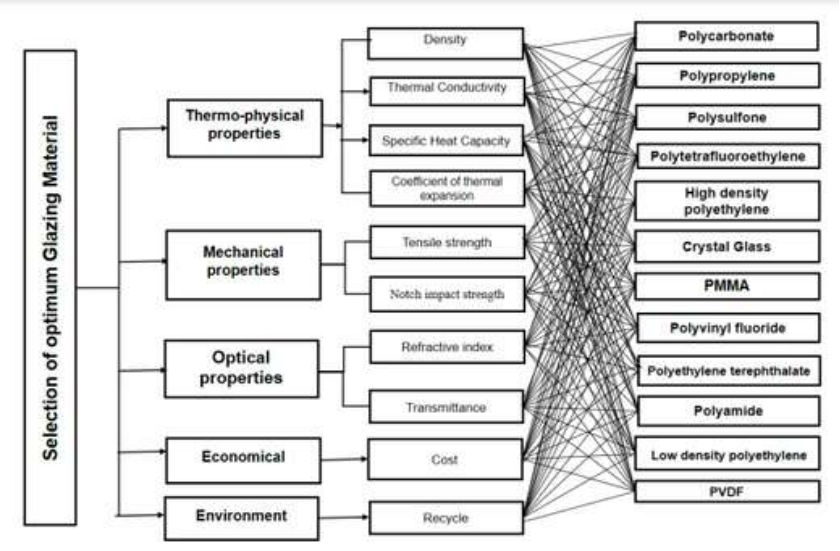


Figure 1. Decision criteria of optimum selection of glazing materials

Meikandan M
Mechanical Department

Selection of optimal glazing material for solar thermal applications using grey relational analysis

This article deals the selection of optimal glazing materials for solar thermal applications with multiple performance characteristics among the twelve alternatives using the Taguchi's grey relational analysis approach. The processing parameters thermal properties, mechanical properties, optical properties, environmental and economic conditions are optimised with multi-response characteristics, including density, thermal conductivity, specific heat capacity, the coefficient of thermal expansion, notch impact strength, tensile strength, refractive index, transmittance, cost, and environment. In this investigation, twelve alternative materials and ten criteria used for material selection for the optimal design. The outcomes revealed that crystal glass has the highest grey grade of 0.588, which is the optimal glazing material among the twelve alternatives.

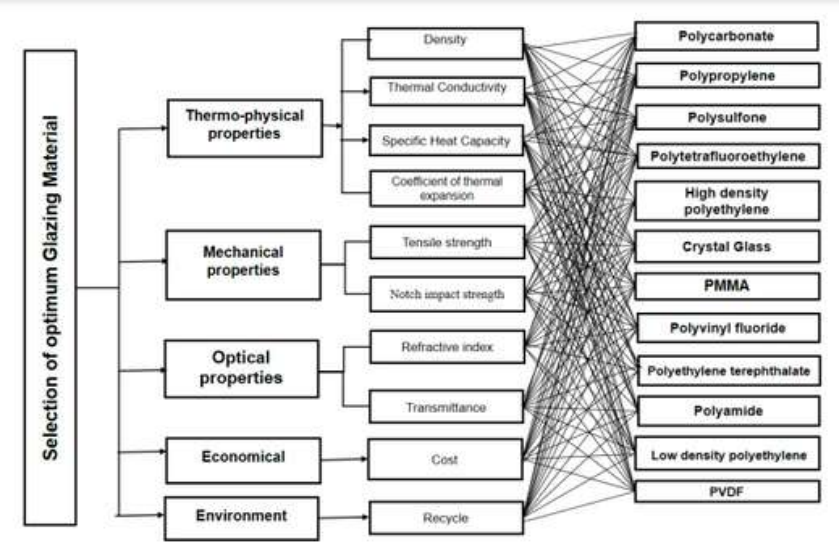
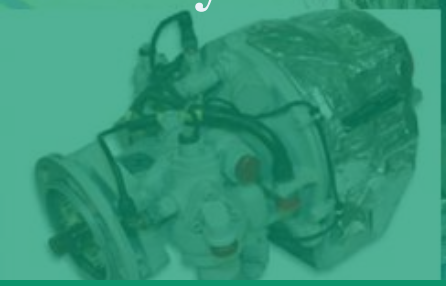


Figure 1. Decision criteria of optimum selection of glazing materials

Meikandan M
Mechanical Department

Efficient Aviation Hydraulic Propulsion System



Distributive propulsion technology brings new opportunities for efficiency improvement and control methodologies development in modern airplanes. The main benefits of distributive propulsion technology are 1) allowing the prime mover and aerodynamic rotor to operate closer to their optimal speed, 2) allowing separation between the prime mover and the rotor, to be able to place the rotor at more efficient locations, and 3) allowing individual speed control of each rotor. The current system utilizes electric generators and motors. However, the drawback of the current technology is the low power to weight ratio, which results in undesirable heavy propulsion systems and low aircraft useful load.

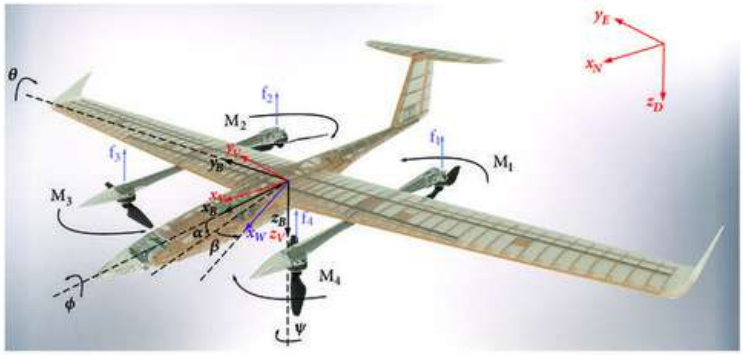
Researchers at Purdue University have developed a new method for planes' propulsion systems. This new method involves using hydraulics to distribute engine power to secondary controllers which create thrust. This new way is more efficient and allows for the optimum use of engine power for any circumstance the plane may be in. This new method utilizing hydraulic systems is lighter (25% of propulsion system weight for the same power level) compared to the electric counterpart.

T. Pavan Charan (VTU11623)
1st year ,Mechanical Department

Hydraulic Propulsion System for Multirotor VTOL Aircraft

Current multi-rotor VTOL aircraft utilize electric propulsion systems to distribute power to the aerodynamic rotors (propeller in most cases) and to control the rotor speed. The current electric propulsion systems rely on electric motors that are heavy and expensive. There is a need for weight reduction of the propulsion system in multi-rotor VTOL aircraft.

Researchers at Purdue University have developed an inexpensive, recyclable hydraulic propulsion system for multi-rotor VTOL aircrafts. The propulsion system utilizes hydrostatic transmission, a lighter weight and more reliable option, to distribute prime mover (engine or electric motor) power to the rotors, providing thrust for the aircraft and allowing rapid control of the speeds of the rotors. This provides both aerodynamic lift and attitude control, eliminating the need for an additional moving control surface or weight shifting device and resulting in a more stable flight and more useful load. For the same torque, an off-the-shelf hydraulic motor can be 4 times lighter than the state-of-the-art electric motor (permanent magnetic axial flux).



Aravind. A (VTU11695)
1st year, Mechanical Department

More Effective Cooling Method for Oil-free Linear Compressor

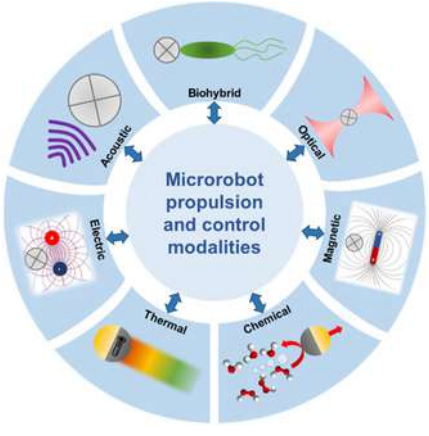
Compressor vapor injection and regeneration is known to increase the efficiency of vapor compression cycles by approaching an isothermal compression process. Historically, research has focused on vapor injection for the scroll/screw compressors with a quantity of oil or vapor gas which limits the refrigerant compatibility and compressor designs. Linear compressors, however, offer very high efficiencies and an oil-free operation. Researchers at Purdue University have developed a novel cooling method for an oil-free linear compressor to approach the isothermal compression process, which provides more effective cooling and consumes less work. In fact, through simulation it was determined that the proposed vapor injection system can reduce compressor power consumption by 8% and reduce the compressor discharge temperature by up to 30^{o}C

Vishal R (VTU11712)
1st year, Mechanical Department

Light Responsive Polymer Magnetic Microrobots

Mobile microrobots have an overall size of less than a millimeter and have to overcome size restrictions that do not allow for on-board actuation, sensing, power, and control. Most mobile microrobots are rigid, monolithic structures, directly manipulated by torques or forces applied by external magnetic, electric, or optical fields globally applied over the entire workspace or pushed by chemical reactions, which leads to inherent coupling of all the microrobots in the workspace. Some recent designs consist of flexible materials that allow a small number of non-actuated or passive degrees of freedom of the robot body or end-effector. Soft active materials have produced microrobots with additional functionalities such as on-demand drug release. Despite their soft active bodies, these microrobots each have a singular function and few degrees of freedom.

High-resolution sensors along with good control strategies are needed to harness the advantages of a high-precision microrobot or manipulation system. Micro-force information is essential to determine underlying biological processes and functions for safe biomanipulation.



V. Harsha Mishra
1st year, Mechanical Department