PES UNIVERSITY

pmr LAB

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Department of Post Graduate Studies
Mechanical Engineering

NEWSLETTER

Editorial

From the editor's desk

It has been an exciting few months at the PMR Lab. From filing our first patent to starting work on new projects, we have had an eventful six months.

Along with continuing work in heat treatment we have recently ventured out into the field of batteries. With our expertise in thermal management of PCB's, applying the same to battery packs was a short step. After securing multiple government funded projects and completing a few consultancy projects, I am happy to say that the initiatives that PES University is taking to improving research are truly paying rich dividends. For this, I am grateful to the management and my team at the PMR Lab.

Over the next few months,we are looking at expansions in our facilities and capacities along with hosting a number of student projects. Things are going to get interesting, and we invite you all to pop in for an update.

- Dr. V Krishna
Editor, Head, PMR Lab

Professor With a View

inspiration indeed

Dr. T R Seetharamu

Chair Professor
Mechanical Engineering

Dr. TR Seetharam is passionate about teaching Thermodynamics and Heat Transfer for Undergraduate students in Engineering. He is also keen in bringing about a radical change in the way laboratory courses are taught and evaluated. Some of these changes are incorporated to a large extent at PES University.He has a number of publications in the field of convection, radiation and heat exchangers. Having served on a number of advisory councils, a textbook in the works and with over 28 publications , Dr. TR Seetharam is an inspiration for hundreds of students and teachers alike.

Eventscape
recent events

Book Release

Dr. K. N. Seetharamu (Chair Professor, PES University), Dr. K.N.B. Murthy (Vice-Chancellor, PES University), Dr. G. Jagadeesh (Chairman, Centre of Excellence in Hypersonics, IISc, Bangalore), Dr. Girish S Deodhare (Director, ADA, Bangalore)

June 26, 2018 saw the release of " Compact Heat Exchangers - Analysis, Design and Optimisation using FEM and CFD Approach" a book authored by Dr. C Ranganayakulu (ADA Bangalore) and Dr. KN Seetharamu (Chair professor, PES University).
Dr. G Jagadeesh (Chairman, Centre of Excellence in Hypersonics , IISC, Bangalore), released the book and mentioned that heat and transfer of heat are one of the most common forms of energy transfer processes. He said that the human body is the most versatile compact heat exchangers in creation. Dr. Girish S Deodhare (Director, ADA, Bangalore) , the Guest of Honor complimented the authors and said that the heat exchangers designed by Dr. Ranganayakulu have proved their mettle in the Light Combat Aircraft project. The event was presided over by Dr. KNB Murthy (Vice-Chancellor, PES University) and witnessed a large gathering of students and admirers of the authors as well as faculty members

A trip to Mexico

Dr. V. Krishna, Professor and Chairperson, Department of Post Graduate Studies, Mechanical Engineering, was invited as Visiting Professor to Tecnologico de Monterrey, Mexico (A Private University in Mexico with 25 campuses, 85,000 students and over 3500 full time faculty members) from 18 August – 2 September, 2018. He visited two campuses – Toluca Campus and Puebla Campus, as part of his visit.

Dr. Alfredo Santana Diaz, Professor Investigador, Technologico De Monterrey, Mexico awarding Dr. V. Krishna a token of appreciation. Dr. Alejandro Rojo Valerio, Director, Centro de Investigacion en Mecatronica Automotriz, Technologico de Monterrey was also present during this event.

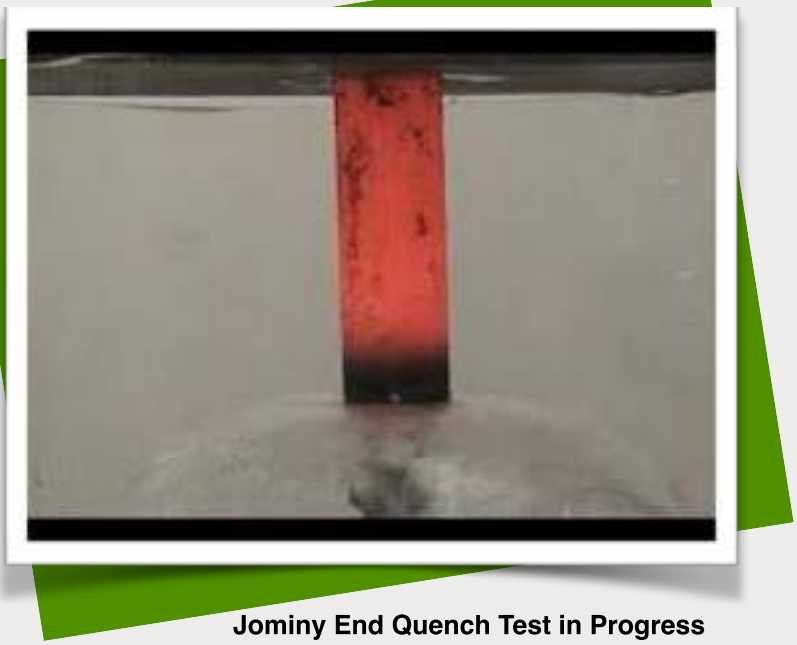
Just out
for the world to see

Estimation of Hardness during Heat Treatment of Steels

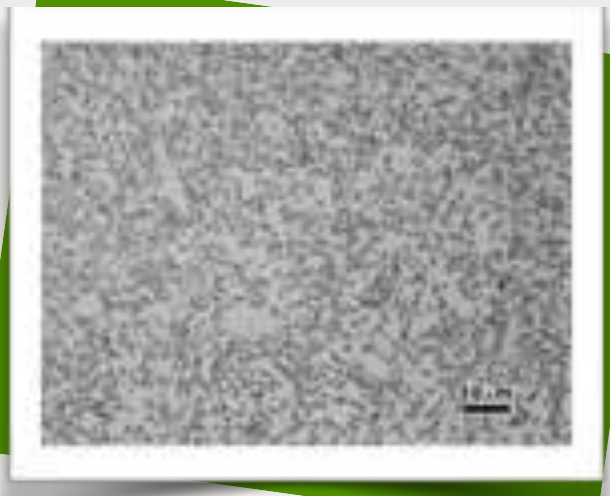
Authors : Abhaya Simha NR, Sushanth MP, Sachin V Bagali, Maruti, TS Prasanna Kumar, V Krishna

To be published in : Material Science and Heat Treatment Journal, Springer Publications

Quenching is an important industrial process wherein the rate of heat transfer plays a vital role in the development of the microstructure and the material properties of the quenched product. In this article a hardness model for steels was developed using the Jominy type end quench test. The steels were heated to their austenitising temperatures and subsequently end quenched. Time-temperat ure data was recorded and the 2D axisymmetric heat conduction problem was solved which when coupled with austenite decomposition models, results in the microstructure distribution and chemical composition of the steels. Following austenising in a furnace at temperatures between 700-800C , the steel samples were tested for hardness and their microstructure was observed. The estimated hardness and experimental hardness and experimentally determined hardness were found to be in good agreement. The models presented in this article for the prediction of hardness can also be used in conjunction with the Inverse Heat Conduction and Austenite Decomposition models to predict hardness in practical processes such as heat treatment and welding.



Jominy End Quench Test in Progress



Microstructure of Austenised Steel

Effect of Carboxyl Graphene Nanofluid on Automobile Radiator Performance

Authors : S Sumanth, P Babu Rao, V Krishna, TR Seetharam, KN Seetharamu

Published in : International Journal of Heat Transfer - Asian Research, Wiley Publications

The improvement of transport machinery depends largely on the increasingly powerful engines that are available in the market. However, they are characterised by the release of exhaust gases at high temperatures; the heat of which needs to be removed efficiently for enhanced performance, usually achieved through radiators. In this article, the effect of carboxyl graphene nanofluid on the performance of an automobile radiator was studied. Nanofluids were chosen because they exhibit superior heat transfer rate compared to conventional base fluids.
Carboxyl graphene nanoparticles were added to a 50:50 ethylene glycol-distilled water solution at concentrations ranging from 0.02%v/v to 0.04%v/v. The effect of the nanofluid was studied using parameters like Nusselt number, effectiveness and friction factor. Through the study, it was seen that a 23-27% increase in effectiveness was observed at low concentrations of the nanopartilce, which later reduced at higher concentrations. Two new correlations were also suggested for determining effectiveness of radiators using nano fluids.

Radiator Test Rig

Effect of Ambient Heat-in-leak on the Performance of Three-Fluid Cross-flow Heat Exchanger

Authors : JyothiPrakash KH

Published in : International Journal of Numerical Methods for Heat and Fluid FLow

Heat exchangers working in cryogenic temperature ranges are strongly affected by heat ingression from the ambient. This paper aims to investigate the effect of ambient heat-in-leak on the performance of a three-fluid cross flow cryogenic heat exchangeer.
The performance of the heat exchanger is determined using Effectiveness-Number of Transfer Units method. The effect of ambient heat in leak to the heat exchanger from the surrounding is to increase the dimensionless exit mean temperature of all three fluids. An increase in heat in leak parameter from 0 to 0.1 reduces hot fluid effectiveness by 32% for an NTU value of 10.

Projects
in the pipeline

Government Projects

Title	Duration	Funding Agency	Amount in INR
Optimisation of Blended Winglets for Trapezoidal Wings	2 Years	AR&DB, Govt. of India	8,03,000
Centre for Design, Analysis and Development of Heat Exchangers	2 Years	KCTU, Govt. of Karnataka & PESU	1,00,00,000
Thermal Design Optimisation of Printed Circuit Boards	2 Years	ISRO,Govt. of India	28,60,000

Consultancy Projects

Title	Organisation / Client	Value in INR
Thermal Management of Battery Packs	ATI Motors	40,000
Automation of Puppet Installation	Indian Musical Experience	35,000
Thermal Analysis of Twin Screw Extruder	Steer Engineering Pvt. Ltd.	25,000

Patents

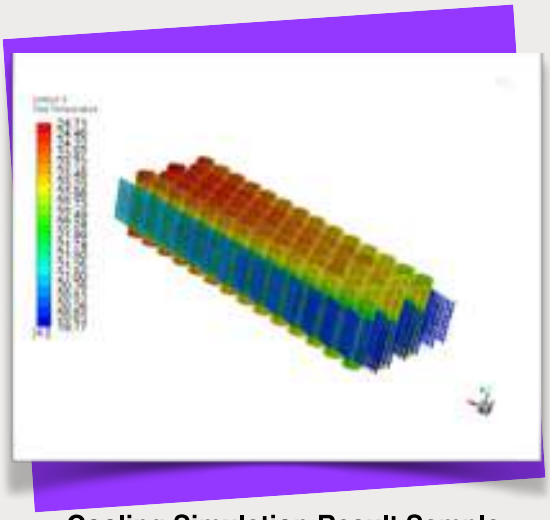
Title	Patent Holders
ADVANCED COOLANT WITH NANO PARTICLES	PES University

Happening Now

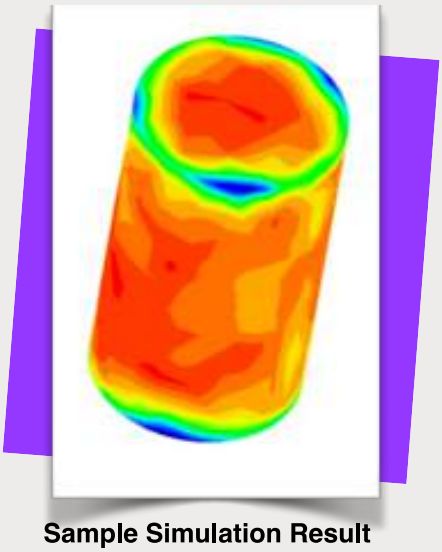
its all in the works

Battery Thermal Management

With offering consultancy in modelling and thermal optimisation of batteries and battery packs, we at PMR lab are currently exploring the applications of thermal management techniques in the field of battery cooling. Batteries, now essential systems of a number of green technologies, are limited in terms of life and capacity both of which depend on their operating temperature.
Sumanth is currently working on thermal behaviour of cylindrical and prismatic Lithium Ion batteries using different SAE drive cycle models.



Cooling Simulation Result Sample



Sample Simulation Result

3D Heat Treatment Simulation

The HTC model which was indigenously developed, was given as a Heat Flux input to the model and the Heat Treatment process is to be simulated to predict results. Initially, simple stainless steel cylinder shapes will be simulated and validated with experimentation. Further work will be extended to complicated shapes and alloy steels.

Mathematical Modelling of Heat Transfer Coefficient During Quenching

Any heat treatment process involves heating the object to a given temperature such that the object is uniformly heated before quenching. The temperature from which it is quenched is called the initial soaking temperature. A method to model the heat flux during quenching is being developed to bring out the effect of the initial soaking temperature.
Quench Probes with different diameter of stainless steel will be used. These probes were quench from different initial soaking temperatures ranging from 700 to 950 C in water. The heat flux and temperature at the quenched surface were estimated based on the inverse heat-conduction method. A model for the surface heat flux will be developed as a function of dimensionless parameters.

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Dr. MR Doreswamy
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Prof. D Jawahar
CEO , PES Institutions
Pro Chancellor

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Dr. KNB Murthy
Vice-Chancellor

Dr. V Krishnamurthy
Registrar

The PMR LAB Team

Dr. V Krishna,
Professor & Head,
PMR Lab
Chairperson
Dept. of PG Studies

Mr. Babu Rao Ponangi
Assistant Professor
Mechanical Engineering

Dr. K N Seetharamu
Chair Professor
Thermal Engineering

Mr. Sumanth S
Research Associate

Dr. T R Seetharam
Chair Professor
Thermal Engineering

Mr. Abhay Simha
Research Associate

Dr. B Rammohan
Associate Professor
Mechanical Enginerering

Mr. Sushanth MP
Research Associate

Mr. Jyothiprakash K H
Assistant Professor
Mechanical Engineering

Mr. Srivatsa
Research Associate