



OFFICE OF ALUMNI AND CORPORATE RELATIONS
INDIAN INSTITUTE OF TECHNOLOGY MADRAS



M.A. PARAMESWARAN INSTITUTE CHAIR

2024 - 2025 REPORT



Chair Occupant



Dr. A. Ramesh
Department of Mechanical Engineering

About The Occupant

M. Tech and Ph.D in Internal Combustion Engines from IIT Madras. Post-doctoral research at Ecole National Superior De Nantes (EMN), France. Currently Prof. M A Parameswaran Institute Chair Professor at IIT Madras. Ramesh started his career as an Assistant Manager in the engine R & D in Bharat Earth Movers Limited. Subsequently joined IIT Delhi where he worked in the Department of Mechanical Engineering as an Assistant Manager. In 1995 he joined the Department of Mechanical Engineering in IIT Madras where he is currently an Institute Chair Professor. He has guided several students for their Ph.D and Masters degrees and has published more than 190 research papers in Journals and Conferences. He works on several projects jointly with Automotive Industries. He has also undertaken several sponsored projects and has played a key role in the establishment of the Automotive Laboratories at NCCRD at IIT Madras. Out of the 21 patents that he has filed/been granted, many are with automotive industries.

Prof. Ramesh has received the Srimathi Marti Annapurna Gurunath Award for Excellence in Teaching from IIT Madras, Life Time Achievement Award from SAE India (Southern Section) and the Baghyalakshmi Krishna Iyengar Award five times at IIT Madras. He was also given the Gem of ACCET award. He was also judged by the outgoing students at IIT Delhi as the best teacher. Several of his B.Tech, M.Tech and Ph.D students have won best project and thesis awards at IIT Madras and at IIT Delhi. He served as the Chairman of the Center for Continuing Education at IIT Madras during which time the Web Enabled M.Tech for industry sponsored candidates was started. He has been on several expert committees in DST, MNRE, ARAI, CSIR, TIFAC, DRDO, AICTE, ADE, NITs and IITs.

TEACHING AND RESEARCH HIGHLIGHTS (INCLUDING CURRENT RESEARCH)

TEACHING

The courses that are generally handled in the past 5 years are:

- ME Energy Conversion Systems (2023-24)
- ME6152 Engine Systems and Performance (2023-24)
- ME1100 Thermodynamics (2023-24)
- ME Engine Instrumentation and Electronic Management
- ME Hybrid and Electric Vehicles
- ME Engine Combustion and Pollution

RESEARCH

The main areas of research are combustion and emission control in Internal combustion engines, Hybrid electric drives for automotive applications, Alternative fuels and novel combustion systems like reactivity controlled compression ignition, Gasoline Direct Injection and hot surface ignition. Engine instrumentation and control. The following are the main research activities and projects.

RESEARCH AND DEVELOPMENT PROJECTS (2023-24)

Development and validation of a cost-effective hybrid electric drive solution for small two wheelers for reducing CO₂ emission (HERCET)

This a team project involving two German and two Indian partners with the aim of reducing greenhouse gas emissions through the development of a hybrid two wheeler that will be finally prototyped and demonstrated. This project is funded by the Indo-German Society for Science and Technology and the German DLR. M/s TVS Motors and VEMAC are the two industries involved. This work is nearing completion and the prototype two wheeler that was successfully developed was recently demonstrated in the Indo-German Science and Technology Cooperation, Golden Jubilee Celebrations in Delhi. The work involved detailed simulations, laboratory experiments and field trials. A novel two speed automatic low cost transmission has also been developed and a patent has been applied for the same. This project will also pave the way for future hybrid power train development for small applications with in our country and also enable future collaborative work. A Ph.D scholar, another M.Tech and two B.Tech students are working on this project.

Development of a Hydrogen Diesel Dual fuel engine for stationary applications

Simulation and experimental studies are being conducted by a Dual Degree student in order to reduce the consumption of diesel and also reduce soot, HC and CO emissions by substitution with diesel in a common rail engine. The most suitable injection strategies, load ranges and the amount of hydrogen to be used will be estimated using a validated simulation model and demonstrated using actual experiments. Since hydrogen will enhance the combustion rate and NO_x emissions, methods like water injection and dilution of the charge with exhaust will be tried. This project will have practical importance since it will pave the way for the development of efficient hydrogen diesel engines for stationary power generation.

Development of a AI based control strategies for a common rail CI engine fuelled with methanol diesel blends

This work is being done by a M.Tech student on a state of the art diesel engine in order to utilize the renewable fuel methanol. This project is aimed at reducing the consumption of diesel through the use of the maximum possible amounts of methanol while simultaneously controlling emissions of particulates. Since several engine parameters like injection pressure, pilot, main and post injection timings and durations, turbo boost pressure, EGR and load will play an important role and conducting experiments will be a very tedious task, AI based control strategies that use minimal experimental data will be developed, validated and used.

A Novel Biofuel Based Twin Injector Multi-mode Genset Engine for High Performance and Low NOx Emissions - Development and Demonstration

A novel twin injector biofuel based premixed charge compression ignition advanced combustion RCCI engine was developed under this project that was funded by the Science and Engineering Research Board. The collaborating industry was Mahindra. The work involved initial CFD studies for establishing the viability of the concept and also to determine the governing parameters. The validated CFD model was used to determine the orientation of the second injector's holes given its offset location. The injectors were developed with the help of the industry partner. The engine was actually modified with the second injector and experiments were conducted. The early injection of diesel was done using a narrow angle injector while the near TDC injection was done with the conventional injector. The use of the narrow injector reduced the wall impingement effects common encountered with early injection of diesel. The later injection of diesel was done with the conventional injector. The two injectors were mounted with a special arrangement on the cylinder head and controlled by a special software in the engine control unit. This system has been patented and research papers have been published. Subsequently the use of Di-methyl Ether as the high reactive fuel along with biogas was demonstrated so that the engine can be operated with 100% renewable fuels with very low NOx emission levels and high thermal efficiency. Two M.Tech students worked on this project along with a Ph.D scholar.

STUDENT CONTRIBUTIONS

The following students and research staff contributed directly towards the above mentioned projects. The projects enabled them to work on practical problems that needed both theoretical and experimental work to be done. Often the developments were demonstrated under field conditions and thus the students had hands on experience on building and evaluating systems. They had to take a multi-disciplinary approach. There were patents that were filed and also publications in reputed journals and conferences.

The following students contributed to the projects mentioned above:

- a) Pranav Sai (M.Tech Student, completed)
- b) Anirudh Koya (M.Tech Student, completed)
- c) Abhishek Bhaduria (M.Tech Student, completed)
- d) Pradeev E (PhD, PMRF)
- e) Gopa Kumar S (Ph.D)
- f) Shivaji Biyodi (M.Tech)
- g) Anirudh Krishna
- h) Animesh Shukla

RECENT HONOURS AND AFFILIATIONS

- Awarded the Life Time Achievement Award by SAE India Southern Section in 2018.
- Awarded the Gem of ACCET award in 2017.
- Srimathi Marti Annapurna Gurunath Award for Excellence in teaching by Indian Institute of Technology Madras, 2017.

PATENTS GRANTED IN 2024:

- A system for boosting the air supply to single cylinder diesel engines by supercharging and turbo-compounding. Patent No. 502412 Granted on 23/01/2024.
- A plenum unit for a turbocharged single cylinder diesel engine. Patent No. 397520, 2024.
- Injection strategy for multimode operation (RCCI/CDC) of a twin injector engine for simultaneously using a low cetane fuel along with a high cetane fuel. Patent No. 521157, 6-03-2024.

PLANS FOR THE YEAR 2024-25

- Optimization studies on the performance and emissions of a parallel hybrid two wheeler for sizing of the components for a particular operating scheme.
- Development and demonstration of a two wheeler with control strategy for fuel economy employing a novel two speed automatic gear train.
- Experimental studies on hydrogen diesel and methanol diesel common rail engines.
- Advising the team working on developing Common Rail Fuel Injection System for defence applications.

JOURNAL PUBLICATIONS

- Pradeev Elango and A. Ramesh, "Numerical Evaluation of Fuel Consumption and Transient Emissions of Different Hybrid Topologies for Two-Wheeler Application", SAE International Journal of Electrified Vehicles, doi.org/10.4271/14-12-03-0019, 2024.
- Ramkumar J, Krishnasamy, A, Ramesh "A novel method to overcome the shortcomings of turbocharging a single cylinder diesel engine", in International Journal of Engine Research, "A", 2021;24(3):873-887. doi:10.1177/14680874211066744.
- Gopa Kumar Sukumaran Nair, Akhil Balakrishnan, A. Ramesh, "Development and experimental validation of a novel twin injector concept for a biogas diesel RCCI engine", in International Journal of Engine Research, doi/10.1177/14680874241264337.
- Ramkumar J, Krishnasamy A, Ramesh, "A novel layout to charge a single cylinder diesel engine using supercharging and impulse turbo-compounding", in International Journal of Engine Research, 2023;24(9). doi:10.1177/14680874231175397.
- R Anoop Krishnan , Kasinath Panda and A Ramesh, "Investigations on the effects of injection parameters and EGR in a glow plug assisted methanol fuelled Hot Surface Ignition (HSI) Engine", ", in International Journal of Engine Research, 2024, doi.org/10.1177/1468087424124156.
- Ramkumar J, Krishnasamy A, Ramesh, "Design of a novel impulse turbine for exhaust energy recovery in a commercial load carrier single cylinder diesel engine", 2024, International Journal of Engine Research, <https://doi.org/10.1177/146808742412673>.
- Ramkumar J, Krishnasamy A, Ramesh, "Novel Approaches of Charging and Compounding a Single-Cylinder Diesel Engine", 2024, International Journal of Engine Research, Accepted for publicationDOI:10.1177/14680874241295578

Thank You

We are grateful to the contributors for your commitment to our organization, and belief in our mission. Your generosity is an inspiration to all of us, and we cannot thank you enough for your support.



Indian Institute of Technology Madras
Chennai - 600036
www.iitm.ac.in

For more information, please contact:
Office of Alumni and Corporate Relations
T: +91-44-2257 8390 | acr.iitm.ac.in

February 2025

