

DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING

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www.me.up.ac.za

OUR RESEARCH IMPACT

EBIT's Department of Mechanical and Aeronautical Engineering houses a number of world-class research groups, staffed by leaders in their field conducting cutting-edge research into various fields. The Department focuses on the pursuit of excellence, quality, international competitiveness and local relevance. It considers a contribution to the competitiveness of the country and the improvement of the quality of life of its citizens, an important part of its mission.

OUR EXPERTS

- **Prof PS Els** (B2 NRF-rating): Vehicle dynamics, control and mechatronics
- **Prof PS Heyns** (B2 NRF-rating): Digital twins, vibration monitoring, mining mechanisation, asset integrity management
- **Prof KJ Craig** (C1 NRF-rating): Computational fluid dynamics
- **Prof J Dirker** (C2 NRF-rating): Heat transfer and thermodynamics
- **Prof S Kok** (C2 NRF-rating): Computational structural mechanics
- **Dr WG Le Roux** (C2 NRF-rating): Heat transfer, thermodynamics, concentrated solar power
- **Dr A Oberholster** (C2 NRF-rating): Vibration monitoring, non-contact measurement, biomechanics

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- Heat Transfer Laboratory
- Solar Laboratory
- Structural Mechanics Laboratory
- Vehicle Testing Laboratory
- Wind Tunnel Laboratory

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RESEARCH OPPORTUNITIES

CENTRE FOR ASSET INTEGRITY MANAGEMENT (C-AIM)

C-AIM explores a wide range of aspects pertaining to the structural integrity and performance of physical assets, such as power generation equipment, automotive and aeronautical structures and mining equipment. Engineering assets are increasingly used past their original design lives. This happens in the context of growing safety and environmental concerns, as well as continuous financial pressure. Trends like these require an in-depth understanding of all aspects of the asset integrity management process, and a new generation of engineers and scientists need to be educated with a proper understanding of the asset life cycle and the interdisciplinary nature of this process. This field also creates very exciting new research opportunities in the context of the fourth industrial revolution. The centre hosts various research programmes related to Eskom, the SAMERDI Research Activity in Mechanised Mining Systems and the Epiroc Forum.

VEHICLE DYNAMICS GROUP (VDG)

VDG exposes students to vehicle dynamics as well as vehicle-related mobility, robotics and mechatronics. It promotes the study, understanding and application of vehicle dynamics nationally and internationally through the South African version of the Baja SAE® competition. VDG collaborates extensively with industry, encourages research activities through postgraduate studies and facilitates national and international collaboration with other institutions. The objective of its research is the improvement of vehicle safety, occupant safety, comfort, reliability and efficiency. Extensive use is made of experimental, as well as analytical and computational tools and techniques, including mechatronics and control, to achieve a deep fundamental understanding of vehicle dynamics and vehicle.

CLEAN ENERGY RESEARCH GROUP (CERG)

CERG conducts fundamental and applied research in thermal and fluid flow systems, including heating and cooling systems, heat exchangers, thermal storage, regulation systems, solar collectors, wastewater treatment, and thermodynamic cycles. The group's expertise spans micro (e.g., electronics), macro (e.g., industrial equipment) to global scales (e.g. environmental impact), using world-class experimental methods, empirical modelling, numerical simulation, Lattice Boltzmann methods, and quantum computing. Key focus areas include single-phase convection, multiphase interactions, conduction, mass transfer, and phase-change processes such as evaporation, boiling, condensation, melting, and solidification. CERG also explores digitization and high-level integration of thermal energy system models to enhance energy efficiency and improved implementation into sustainable energy systems.

SOLAR THERMAL ENERGY & POWER SYSTEMS (STEPS)

The STEPS research group is dedicated to the testing and development of novel technologies related to small-scale concentrated solar power (CSP) systems and small-scale power generation systems. Recent focus areas include using CSP for the melting and recycling of metals, as well as using CSP as a heat source for power generation with a microturbine. Other focus areas include the integration of microturbines with thermal energy storage and water heating, as well as CSP applications in manufacturing, construction, distillation, fuel production and desalination. The group specifically aims to address the energy needs (thermal, mechanical and electrical) of various small-scale sectors in South Africa. Facilities include a solar laboratory with multiple solar dish setups.

ULTRASONIC RESEARCH GROUP

The work at the Ultrasonic Research Laboratory is at the forefront of exploring and expanding the horizons of ultrasonic technology. The state-of-the-art lab, acts as a hub for innovation and discovery of new and novel domains in order to push boundaries, develop new applications, and promote the adoption of ultrasonic measurement and monitoring across various industries.

AERONAUTICAL GROUP

Aerospace (Aeronautics and Space) Research and Development is a global business. The future challenges of air transport, such as climate change, limitation of energy resources, push the leading worldwide aviation research institutions, such as the CSIR, NASA, TsAGI, ONERA, DLR, JAXA to consolidate the applied research. Applied Research will also be embedded more and more in teaching in order to prepare the future generation of aerospace graduates to work in the 21st Century Aerospace Industry.

POSTGRADUATE DEGREE PROGRAMMES



More information on postgraduate studies in the Department of Mechanical and Aeronautical Engineering

Honours programmes

The Department's honours degree programmes prepare students for a career in research through taught modules. However, there is also a strong need for these programmes in industry, without students having to commit to master's degree studies.

BEngHons Mechanical Engineering • BScHons (Applied Science) Mechanics • BScHons (Applied Sciences) Physical Asset Management

Master's programme

Through the Department's master's programmes, the student initiates, plans and executes a scientific investigation on a mechanical engineering topic and then writes a dissertation on the research project and its findings.

MEng Mechanical Engineering

Doctoral programme

A doctoral degree in the Department is awarded for a successful thesis on advanced original research that makes a real and substantial contribution to the knowledge of engineering science or practice.

PhD Mechanical Engineering

Curriculum, rules and regulations: www.up.ac.za/yearbooks/home

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