Zurich University
of Applied Sciences

School of Engineering

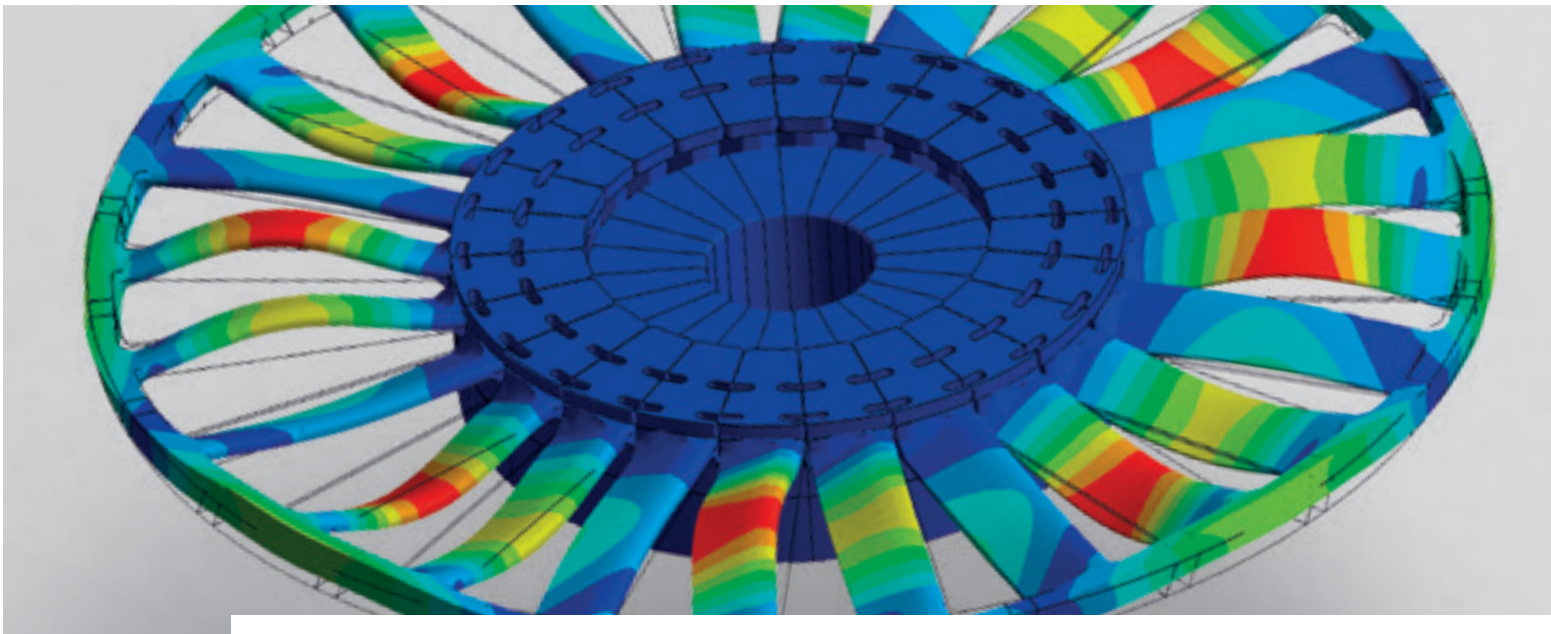
Institute of Mechanical Systems (IMES)

Zurich Universities of
Applied Sciences and Arts

www.zhaw.ch/imes

Research and Development

Institute of Mechanical Systems (IMES)



The core R&D competencies of the IMES lie in the area of mechanically highly-loaded structures. The focus is on the three application areas of biomechanical engineering, lightweight construction engineering and applied mechanics. Components are developed, tested and simulated both analytically and experimentally.

Applied mechanics

Mechanical components are often subjected to extreme conditions. The accidental failure of critically loaded components repeatedly leads to expensive damage which often exceeds the costs of the components themselves many times over. Turbine rotors, for example, are subjected to thermomechanical loading at high operating temperatures. The combination of varying loads with simultaneously changing temperatures leads to fatigue and crack formation in the material up to the point of failure.

The IMES simulates mechanical components under static and dynamic load and validates the results experimentally. Along with that of metals, the behaviour of complex polymer materials under mechanical loading is also considered. The non-linear material properties required for realistic simulations are experimentally determined at the institute. The IMES thus creates a basis for the optimal development of mechanical components and systems.

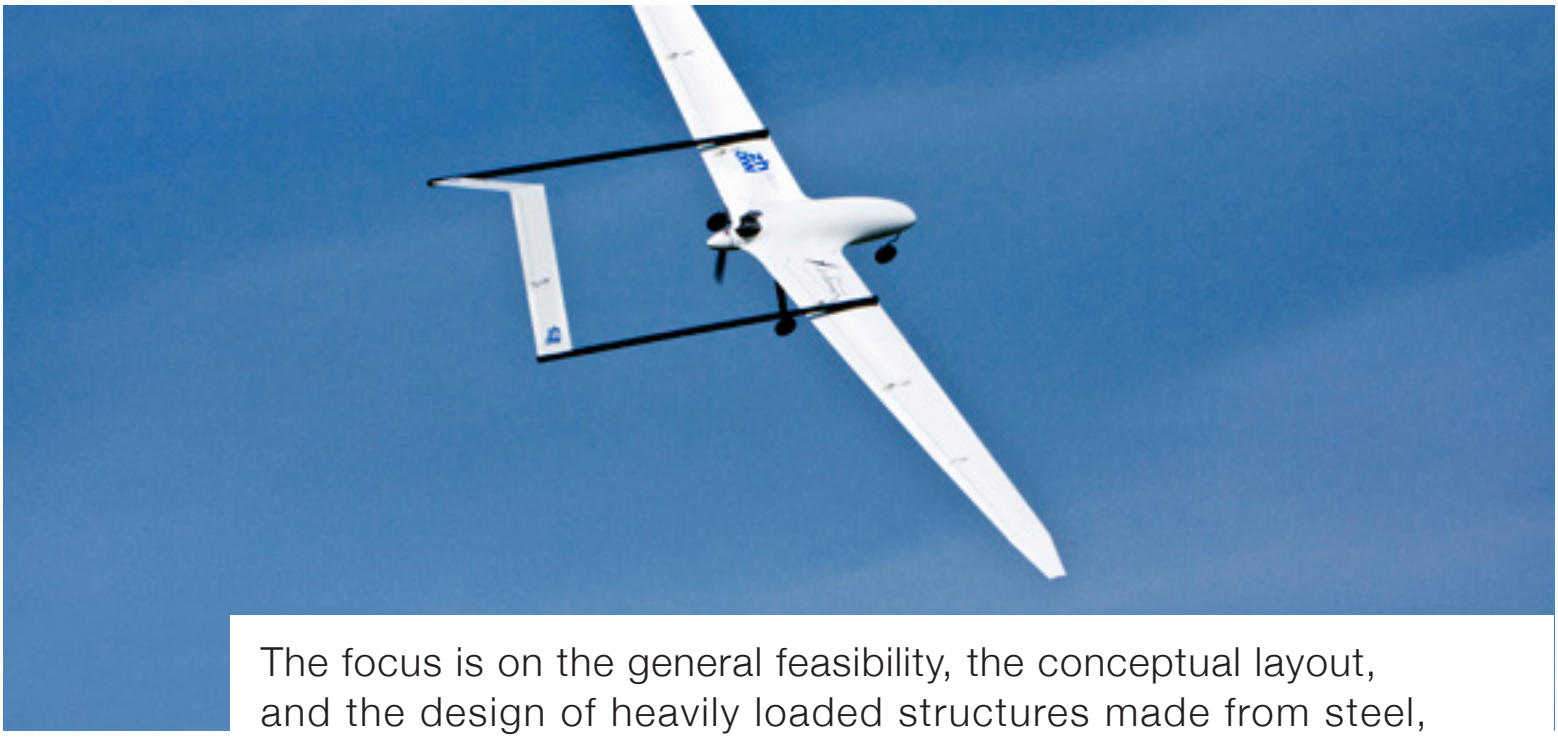
Biomechanical engineering

In the area of biomechanical engineering, the IMES researches the function and forces of the human musculoskeletal system, in particular joints, in order to develop and validate implants and surgical instruments based on these findings.

New implants are experimentally tested in an accredited laboratory in accordance with ISO 17025 to ensure that the product fulfils the required functions and withstands the loads. The IMES experiments are performed in accordance with applicable ISO standards. The institute collaborates with the customer to develop and validate appropriate test procedures for innovative products. The auxiliary equipment required to accomplish this is designed by the IMES and manufactured in the institute's own workshops.

In addition to orthopaedic products, the areas of ergonomics and ambient assisted living systems have been specifically strengthened and expanded during the past years. The human-machine interaction can be characterised using 3D motion measurement systems, force plates and muscle activity measuring systems (EMG).

Lightweight construction engineering



The focus is on the general feasibility, the conceptual layout, and the design of heavily loaded structures made from steel, light metal alloys and fibre composites.

Adaptive materials and structures can be used for lightweight structures to achieve a customised dynamic layout, which is specifically designed for the frequency spectrum of the occurring loads. This makes it possible to achieve higher efficiency. The non-linear behaviour of the aerodynamic or hydrodynamic loads can also be considered.

The broad network within the School of Engineering allows us to handle cross-curricular projects using interfaces with structural mechanics, linear and non-linear materials engineering, thermal analysis, aero dynamics, and control systems with multiple inputs/outputs. There is a focus on the design of structures and systems for motor vehicles, air planes, drones and wind turbines.

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The School of Engineering at the Zurich University of Applied Sciences is one of Switzerland's leading technical universities. It provides top-quality education and training while providing the industry and business with innovative solutions in the fields of energy, mobility and health.

We will be delighted to help you develop and refine your products, and you can rely on us to be a skilled partner for your business activities. Please don't hesitate to contact us.