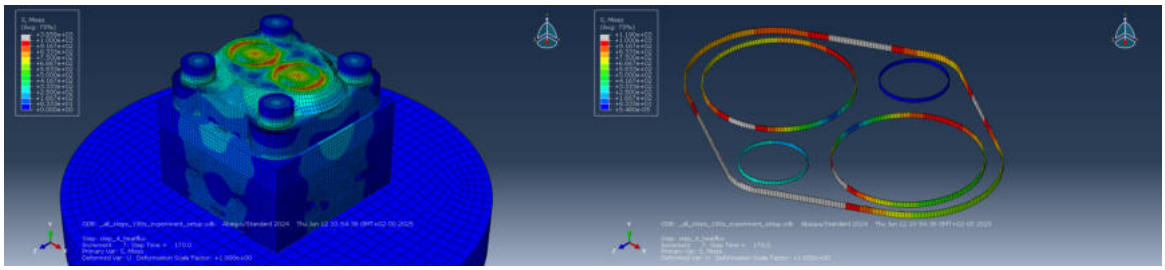
Karlsruher Institut für Technologie

IFL
Institut für Fördertechnik und Logistiksysteme

Bachelorthesis/ Masterthesis

Optimization of force transmission points in flange connections for fusion reactors



Field: In the context of developing mechanical multi-pipe connections (MPC) for fusion reactors, the safe, space-saving and remotely operable design of flange connections represents a key challenge. The tightness and understanding of such metal seal connections are of particular interest. The arrangement and number of bolts have a significant influence on the sealing function, stress distribution and structural rigidity of the overall system. The work is based on current development stages and prototypes and uses numerical methods for structural evaluation.

Problem Statement: Despite geometric optimizations, current MPC flange designs still exhibit an inhomogeneous distribution of sealing pressure and local stress maxima. Screw positioning has been heuristic up to now and has not been systematically optimized. Particularly under realistic boundary conditions (temperature, preload, edge stiffness), there is a research gap regarding the specific influence of screw arrangement on sealing behavior and structural integrity.

Required Skills: The aim of this work is to systematically optimise the screw positioning of an MPC flange using finite element methods (FEM).
To this end:

- Suitable evaluation parameters are to be defined.
- The existing FEM model is to be further developed.
- Different bolt arrangements are to be investigated and compared.
- An optimized bolt concept is to be derived and evaluated in terms of design.

Benefits: The thesis offers a current and practical research topic in the field of fusion and high technology. The work will be carried out with expert supervision and close links to active research and devel-

Research Group:
Simulation and optimization of mechanical systems

Thesis Type:
Simulation

Majors:
Mechanical Engineering, Mechatronics

Start Date:
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opment project. At the same time, a high degree of freedom is allowed in the methodological design of the thesis. The requirements will be adapted to a Bachelor's or Master's thesis and can be discussed individually. Depending on the results, there is the possibility of aiming for a scientific publication after completion of the work.