

Bachelor/Semester/MasterThesis IDSC-CO-FS19

Design and Realization of a Novel Actuator for Implantable Pulsatile Artificial Hearts

**Background**

Long term mechanical circulatory support systems are based on implantable non-pulsatile turbodynamic flow pumps or external non-implantable pulsatile volume displacement pumps. As part of the Zurich-Heart Project, an initiative of the "Hochschulmedizin Zürich," a new concept of a fully implantable artificial heart based on a soft-machine concept has been developed. In its current design the central volume displacement chamber is driven by an external hydraulic drive.

Problem Definition

This solution is not suitable for clinical applications. External hydraulic drives have the disadvantage of a large mobile driver unit and require a rigid tubing that penetrates the body surface. Hence there is an increased risk of infection and limited quality of life. The main goal is to explore potential solutions for an implantable pulsatile volume displacement actuator that is compatible with the principles of the soft machine concept and that can be contained completely in the patients body.

Task

First a general survey of potential solutions is required (general morphological analysis) and then one solution, which is considered the most promising approach, is analyzed in greater detail (design, modeling, analysis etc.). Second, a working prototype of the actuator has to be designed and realized (you will be supported by experienced technicians in that step). Third, this prototype will be tested in existing HW-in-the-loop simulators and, based on the results, recommendations for improved actuator designs are to be formulated.

In your work you will be supported by several groups: the medical team of Prof. Falk will assist you in all questions regarding the cardiovascular system, the team of Prof. Stark will provide the soft-machine heart system and the team of Prof. Guzzella will support you in the design and realization of the actuator.

Prerequisites:

Experience in modeling and design of mechatronic systems; interest to learn more about medical (cardiovascular) problems; ability to work independently, but in close coordination within an interdisciplinary team.

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