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Abstract:

Robots are important tools in our everyday life. Both in industry and at the consumer level they serve the purpose of increasing our scope and extending our capabilities. Modular robots take the next step, allowing us to easily create and build various robots from a set of modules. If a problem arises, a new robot can be assembled rapidly from the existing modules, in contrast to conventional robots, which require a time

consuming and expensive development process. In this thesis we define a modular robot to be a robot consisting of dynamically reconfigurable modules.

The goal of this thesis is to increase the versatility and practical usability of modular robots by introducing new conceptual designs. Until now modular robots have been based on a pre-specified set of modules, and thus, their functionality is limited. We propose an open heterogeneous design concept, which allows a modular robot to be easily extended with new functionality. In addition we introduce deformability, a new means for modular robots to perform autonomous adaptation to changing environments, and enabling parallel actuation.

This thesis presents two new modular robotic concepts, the Odin and Thor modular robot. The Odin robot realizes both deformability, and is based on the open heterogeneous design concept. The Thor robot focuses on the open heterogeneous design concept. The robots are brought outside the lab, to the ICRA Planetary Robotic Contingency Challenge, to test their potential, and evaluate the concepts in a real world scenario.

We encourage further research in deformability, distinguishing between parallel and collective actuation, and the ability to passively adapt to changing environments. For this thesis, deformability, and the complexities involved, started to curtail the practical usability of the modular robots presented. However, we conclude, that the open heterogeneous design concept can increase the versatility of modular robots, and bring us towards more versatile robots in general.