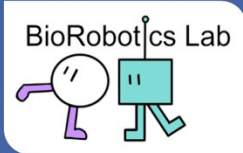# Optimization and Biomechanics for Human Centred Robotics
KIT BioRobotics Lab

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Endowed Chair by Hector Foundation II
Institute for Anthropomatics and Robotics (IAR)

Bachelor's or Master's Thesis:
Numerical accellerator abstraction schemes

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Background

Numerical methods are a core pillar of modern robotics research. This includes both Reinforcement Learning approaches as well as traditional Optimal control approaches, both of which are internally based on optimization methods. The faster the optimization, the faster the methods based on it, the more efficient and effective the robot control and motion generation.

Offloading to accellerator hardware, however, is not quite as straightforward than classical CPU based implementations, and there are different libraries, implementations and approaches available for that, such as SYCL, Kokkos, OpenMP or Vulkan. We would like to know how they fare against each other.

Scope of the thesis

This thesis will focus on the evaluation of different of such technologies used on the same problem and providing comparative benchmarks to investigate the strengths, shortcomings and limitations of each technology based on a set of test problems, both fromt he field of robotics and beyond that.

The student will implement and test these problems in a chosen set of offloading technologies and evaluate their effectiveness and performance in offloading the problem to a GPU or other accellerator hardware.

The exact scope of the thesis depends on whether it is a Bachelor's or a Master's thesis. A code framework for this work will be provided.
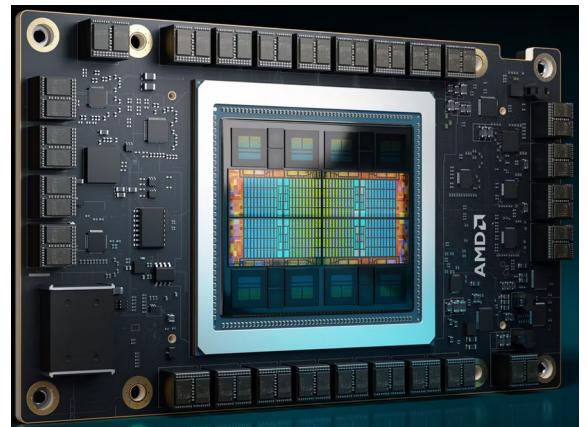
Recommended knowledge

- fundamental knowledge about mathematical or numerical methods
- C++ programming experience
- prior contact with GPU programming helpful