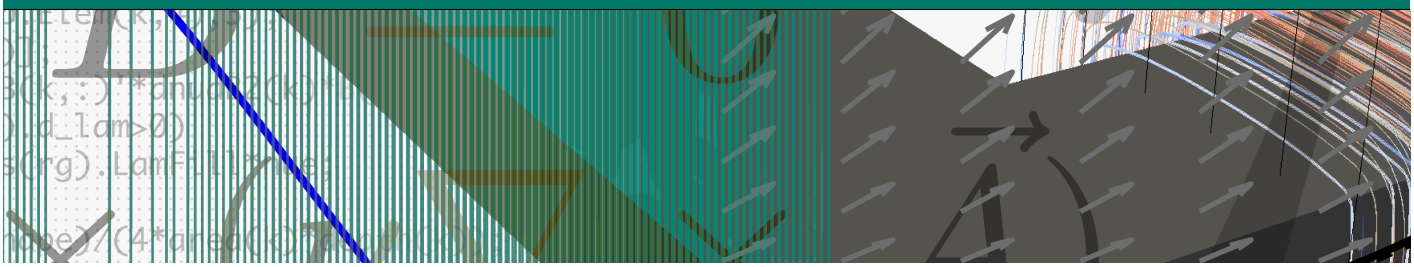
Automatic Wrapper Generation to Port Material Properties to Various Programming Languages

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a student research assistant (HiWi) position (or a Bachelor's/Master's thesis)
Study field: Computer Science | Computational Engineering | Electrical Engineering | Material Science



Description

Material relations are a key factor when it comes to accurate simulations of complex machines such as the superconducting magnets of the LHC particle collider at CERN. To this end, a lot of effort is spent on finding appropriate fits of various different materials under various different operating conditions. The results are typically kept in libraries, in the case of CERN as functions written in C (see here). These functions are then to be used in different simulation tools which, however, often require a translation of the material function into a different programming language (typically, to python or Matlab).

So far, this translation is done mostly manually. This implies that changes to the common basis C functions require changes in all translated versions as well. To avoid this cumbersome manual process, this announcement proposes an automatic wrapper generation of the base C function to other programming languages using, for example, the software development tool SWIG.

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Work plan

- Familiarization with existing material laws in C and tools for automatic wrapper generation to python and Matlab
- Implementation of automatic wrapper generation for existing functions
- Setup of automated and comprehensive building and testing of the implementation as part of a CI/CD pipeline
- The project can also be done as a Bachelor's or Master's thesis, then a more theoretical analysis of different material fits used for the simulation of superconducting magnets will be performed (details TBD)

Prerequisites

Basic knowledge of programming in C, C++, python and/or Matlab is beneficial but not a necessity (can be learned as part of the introductory phase)

CEM