Asynchronous Iterative Methods for Efficient Simulation of Electrical Machines

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's, Master's thesis or Projectseminar
Study field: Computational Engineering | Computer Science | Electrical Engineering | Mathematics
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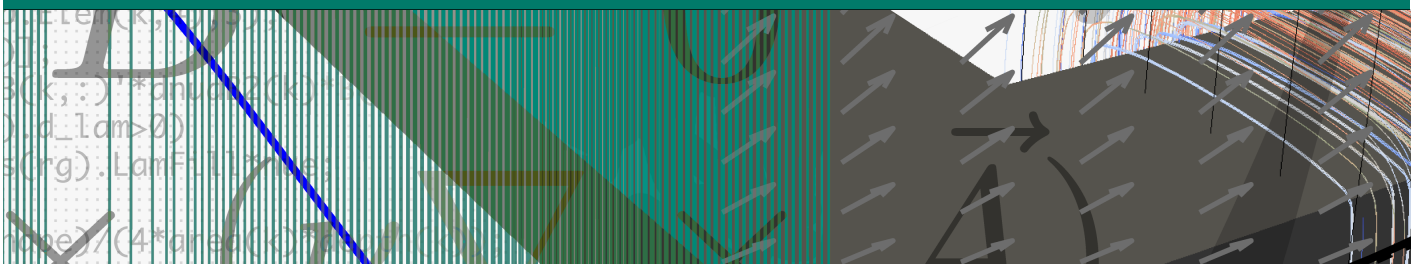

Description

In computational engineering, one often encounters the so called fix point update formula $\mathbf{x}^{(k+1)} = \mathbf{\Phi}\left(\mathbf{x}^{(k)}\right)$, which arise naturally in various numerical methods. In some contexts, the corresponding update function $\mathbf{\Phi}\colon \mathbb{R}^n \to \mathbb{R}^n$ contains parallelizable computations. Parallelization enables solving large problems more efficiently but most algorithms entail even more potential to shorten the computation time.

During the so called synchronization parallel threads wait for others to finish and receive updated information before starting the next iteration. This introduces idle time which can be circumvented by applying *asynchronous* approaches, e.g., see [1]. In principle, synchronization steps are neglected, i.e., threads keep iterating even if other threads are not finished yet.

In order to speed-up 3D simulation of electrical machines, this project aims to study *ParaReal* and/or iterative solvers for linear systems arising in *domain decomposition methods* with a focus on asynchronous iterations.

Prerequisites

Exceptional programming skills are necessary for implementing asynchronous methods and evaluating their performance. Experience in HPC is desirable but can be aquired during the project.

References

[1] E. Coleman, E. Jensen and M. Sosonkina. "Simulation Framework for Asynchronous Iterative Methods", *Journal of Simulation Engineering*, vol. 1, 2018.

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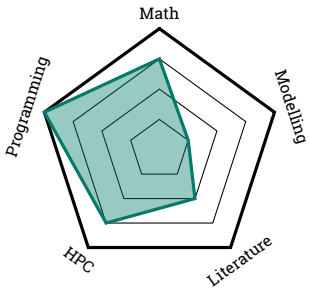
Weighted Core Areas:



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