Implementation of methods to parallelize simulations in the time domain

Bachelor or Master's thesis (Computational Methods in Engineering, Maschinenbau, Mathematik)
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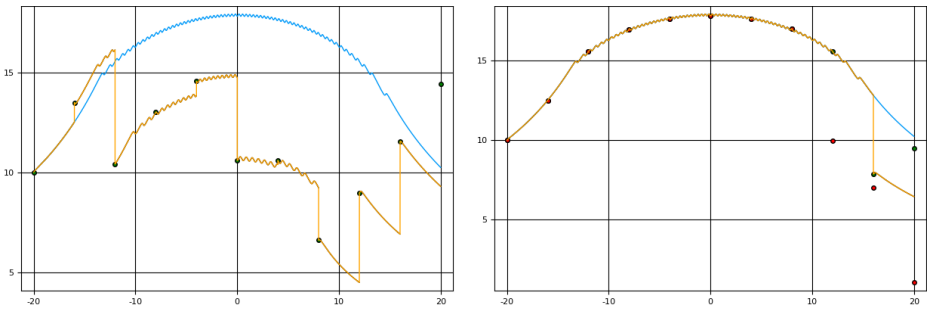
Scope of Work

To date, we have almost reached the limits of transistor performance and thus, it is not expected that a significant increase in CPU speed can be realized in the future. This increasingly restricts the potential of numerical applications in science and industry. Although the efficient usage of highly distributed and parallelized numerical algorithms has become standard practice, we have also reached a point, where the degree of achievable parallelization is saturated. The parallelization we are referring to is related to algorithmic details of underlying linear algebra problems or along spatial dimensions. However, achieving parallelization along the time axis has obtained little attention so far, despite the potential gains in terms of run time.



The main goal of this thesis is to implement parallelization-in-time methods for problems governed by time-evolving differential equations. In this context, methods such as `Parareal` or `Multiple-Shooting` seem very promising and should be studied for elastic wave propagation problems.

Tasks

- Review of the existing literature on parallel-in-time methods
- Implementation of a parallel-in-time method in an existing in-house FE-code
- Investigations regarding the performance in wave propagation problems

Prerequisites

- Computational mechanics (e.g., (Nonlinear) Finite Element Method)
- Programming skills (preferably Matlab or Julia)
- Continuum Mechanics

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