TECHNISCHE DYNAMIK

CoSTAR

Institut für Mechanik
FG Technische Dynamik
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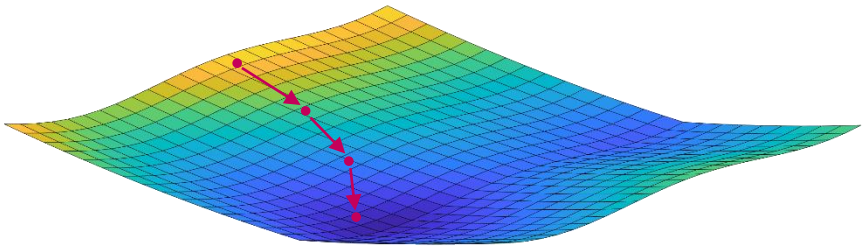

Combined semester and bachelor thesis or master thesis

Extended Newton methods for complex simulations

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Numerical simulations are an indispensable part of an engineer's everyday life today and will play an increasingly important role in the future.
When an engineer carries out a simulation, a non-linear system of equations often has to be solved. These systems are usually too complex to solve analytically, which is why an approximate solution is calculated using a numerical method. One of the best-known representatives here is Newton's method. Here, the corresponding equation is linearised in an iterative process and the zero point of the linearisation is calculated.
In order to increase the process performance, various methods can be applied ("Newton on Steroids"): Damping, simple Newton, optimisation algorithms, neural networks and much more.
Such an extended Newton method is also to be used in the Matlab CoSTAR (Continuation of Solution Torus Approximations) toolbox. This toolbox is currently being developed at the Department of Engineering Dynamics by the Numerics Group. It enables the calculation of periodic and more complex, so-called quasi-periodic oscillations, such as those that can occur in aircraft turbines or wind turbines. Work is currently underway on the second version of CoSTAR, which will then be published as open source code.

Working Steps:

- Learning the theory of Newton's methods and the CoSTAR Toolbox.
- Programming and extension of Newton methods from the literature using simple examples
- Extension of the method with advanced algorithms
- Integration of the Newton method into the CoSTAR Toolbox

Your skill set:

- Independent and self-reliant way of working
- Basic programming skills (ideally Matlab or Python)
- Good to very good knowledge of mathematics

This is what you can look forward to:

- Learning or expanding your programming skills as an essential engineering skill.
- Work is written within an open team, and a friendly and relaxed working atmosphere
- Sufficient orientation phase and excellent supervision with regular consultations
- Workstation at the institute or completely mobile work incl. supervision via Zoom.
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Have we caught your interest? Then send an email to baeuerle@uni-kassel.de.