Einladung zum Oberseminar Wissenschaftliches Rechnen

Julius-Maximilians-Universität Würzburg
Lehrstuhl für Wissenschaftliches Rechnen IX

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Direct Stellarator coil optimisation under uncertainty

When designing a new Stellarator fusion reactor, the design of the coils that generate the magnetic field used to contain the plasma is a crucial step. Once designed, building these coils is extremely expensive and tight manufacturing tolerances only increase the cost further. The classical way of designing coils is a two-stage approach in which first a magnetic configuration with desirable physics properties is found, and then coils that aim at realizing this magnetic configuration are designed.

Recently, a single-stage approach was introduced that directly optimises coils for their physics properties. We combine this approach with a model for coil manufacturing errors to find coil designs that are robust with respect to small perturbations of the coils.

The corresponding stochastic optimization problems are formulated using a risk-neutral or risk-averse approach. We present an efficient, gradient-based descent algorithm which relies on analytical derivatives to solve these problems. In a comprehensive numerical study, we compare the coil designs resulting from deterministic and risk-neutral stochastic optimization and find that the risk-neutral formulation results in more robust configurations and reduces the number of local minima of the optimization problem. We also compare deterministic and risk-neutral approaches in terms of quasi-symmetry on and away from the magnetic axis, and in terms of the confinement of particles released close to the axis.

Ort: Zoom Videokonferenz | Zeit: Mittwoch, 21.07.2021, 14:00 Uhr

Zu diesem Vortrag laden wir Sie herzlich ein.
You are cordially invited to this lecture.

gez. Prof. Dr. Alfio Borzì
gez. Prof. Dr. Frank Werner