Advances in Computational Mechanics

Einladung zum Vortrag

Multiscale Analysis of Failure

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Replacing prototype testing by computer simulation is essential for speeding design cycle times. Since a critical requirement in any design is to prevent failure without incurring high cost, the ability to simulate failure is vital in this paradigm shift from testing to computer simulation. The ultimate goal is to be able to predict macroscale failure starting from computations at the atomistic scale with minimal testing. But computational modeling of failure and reliable predictions are still highly problematic and are one the biggest challenges in computational mechanics. In this talk, some methods for multiscale failure prediction will be described, including both hierarchical and concurrent methods. Particular emphasis will be placed on the situation where the coarse scale model loses ellipticity, which is always the case with failure. Recent progress on a new method for treating that situation is described. Its major feature is the decomposition of the unit cell response into a discontinuity and a smooth response. Two key concepts are fundamental to the development of this method: the notion of a perforated unit cell that excludes all material that is not strictly convex and a method for extracting the discontinuity at the macroscale from the microscale response. The methods are combined with the extended finite element method for the coarse scale model, so that arbitrary discontinuities at the macroscale can be treated. Coupled quantum/atomistic/continuum methods for nanotechnology and their application to nanotubes and grapheme sheets will also be described. We will conclude with an examination of some current challenges.

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14:00 Uhr

Seminarraum LNM
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