CNASC Seminar

Speaker

Dr. Matthias Bolten,
University of Wuppertal

Tuesday, May 7, 2019
1pm, SN2041

Numerical optimization of the probability of failure of ceramic components

Abstract:

Ceramic is a material frequently used in industry because of its favorable properties. Common approaches in shape optimization for ceramic structures aim to minimize the tensile stress acting on the component, as it is the main driver for failure. In contrast to this, we follow a more natural approach by minimizing the component's probability of failure under a given tensile load in the setting of gradient-based optimization.

One of the main challenges in the area of shape optimization is the generation of stable and accurate meshes. As it usually comes as an iterative process, re-meshing is a key bottle neck in the quest for efficient optimization procedures. Hence, current approaches aim to avoid re-meshing by rather moving the grid points. Although these approaches show good results, re-meshing cannot be avoided as the meshes become degenerated after some steps of iteration.

Therefore, we follow a mixed re-meshing/recycling approach based on the idea of composite finite elements. This approach leads to very regular meshes, where we can recycle most of the grid and the entries of the governing PDE, which lead to a speed up in both the mesh generation and the computing of the matrix. Also, the regular structure contributes to means of efficient implementation on modern computer architectures.