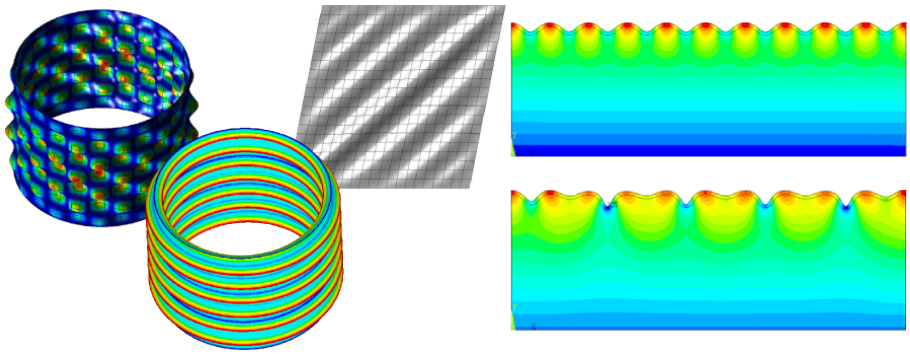
Universität Stuttgart

Baustatik und Baudynamik

Master Theses – Various different topics in the field of

Modeling and efficient simulation of instabilities in structural and solid mechanics

The understanding of instabilities plays a crucial role in various disciplines across science and engineering. In engineering, stability analysis is not restricted to estimating a critical load at which a bifurcation or snap-through point is reached, a so-called primary instability. Knowledge about the post-critical behaviour and possible secondary instabilities is crucial for assessment of stability behaviour and safety of the structure. Instabilities are not restricted to slender structures and may also occur in multilayered systems, composed of thin stiff films bonded to thick compliant substrates. In particular, secondary instabilities result in these cases in very complex patterns, which remain poorly understood. In all mentioned applications, the numerical simulation of instabilities may be highly challenging and inefficient with traditional methods and algorithms, thus opening various possibilities for new developments.



Examples for numerical simulations of instabilities in singlelayered and bilayered systems.

Possible topics may include studies on

- the performance of advanced discretization schemes like isogeometric analysis (IGA) in comparison to traditional FEM in commercial codes,
- effects of different sources of compressive stresses (prescribed forces or displacements, thermal expansion/shrinkage, growth,...),
- developments of novel efficient and robust path-following schemes,
- effects of analysis types, modeling aspects, imperfections, constitutive laws, locking, etc.,
- among many others.

Detailed task descriptions can be discussed and determined between possible candidates and Dr.-Ing. Bastian Oesterle (oesterle@ibb.uni-stuttgart.de).

Recommended fields of interest

Instabilities, FEM, IGA, shells, solids, programming, commercial FE software