KTH SOLID MECHANICS KEYNOTE SEMINAR; Thursday, October 10th, 16.15; https://kth-se.zoom.us/j/68760860408

Ole Sigmund
"Third medium approaches for contact analysis with applications in topology optimization and meta-material design"

Topology optimization for problems with internal or external contact represents a seeming paradox: if the topology is initially unknown, how can one identify contact boundaries? And further: even if boundaries are known and well-described, it is complicated and logistically complex to administrate contact points or surfaces and their associated Lagrange Multipliers. Both challenges can be alleviated using so-called Third Medium Approaches (TMAs), where contact forces are transferred through "void" domains with tailored elastic properties that generate high stiffness when directionally compressed but zero stiffness in shearing. TMAs have obvious strong benefits for inverse design problems but also represent a viable alternative to traditional contact analysis in non-linear elasticity.

In this talk, we discuss and demonstrate recent advances in applying TMAs: 1) improved computational stability through better finite element discretizations; 2) extensions to three dimensions, 3) extensions to multiphysics settings including thermoelectric contacts and 4) inclusion of friction effects by a crystal plasticity framework.

Ole Sigmund is a Professor and Villum Investigator at the Section of Solid Mechanics, Department of Civil and Mechanical Engineering, Technical University of Denmark (DTU). He obtained his Ph.D.-degree 1994 and Habilitation in 2001 and has held research positions at University of Essen and Princeton University. He is a member of the Danish Academy of Technical Sciences and the Royal Academy of Science and Letters (Denmark) and is the former President (2011-15, now EC member) of ISSMO (International Society of Structural and Multidisciplinary Optimization) and former Chairman of DCAMM (Danish Center for Applied Mathematics and Mechanics, 2004-2010). He is elected as the academic representative in the DTU Board of Governors. Ole Sigmund is one of the founders and main contributor to the development of topology optimization methods in academia and industry. Present research interests include theoretical extensions and applications of topology optimization methods to mechanics, multiphysics and metamaterial problems under the consideration of manufacturing constraints, contact and multiple length scales.