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MULTI-SCALE AND COMPUTATIONAL SCALE BRIDGING

DANIEL BALZANI[+], CAGLAR OSKAY*, VARVARA KOUZNETSOVA[†], JÖRG SCHRÖDER[§] AND KENJIRO TERADA[#]

[+]Ruhr Universität Bochum, Universitätsstr. 150, 44801 Bochum, Germany
daniel.balzani@ruhr-uni-bochum.de

[*] Vanderbilt University, PMB 351831 2301 Vanderbilt Place, Nashville, TN 37235, USA
caglar.oskay@Vanderbilt.Edu

[†] Eindhoven University of Technology, Postbus 513, 5600 MB Eindhoven, The Netherlands
v.g.kouznetsova@tue.nl

[§] University Duisburg-Essen, Universitätsstr. 15, 45141 Essen, Germany
j.schroeder@uni-due.de

[#] Tohoku University, Aramaki 6-6-06, Aza-aoba, Aoba-ku, Sendai 980-8579, Japan
tei@tohoku.ac.jp

ABSTRACT

In recent years, considerable progress has been made in connecting the micro- and mesoscopic mechanics of materials to the structural engineering level supported by advances in multiscale modeling. To this end, different classes of computational scale-bridging methods have been developed, spanning various disciplines, e.g. engineering, computational mechanics, mathematics, physics, and chemistry. Although these methods are usually designed for specific research problems, from a methodological point of view, similarities and distinctive features can be identified.

This invited session intends to bring together scientists from different disciplines working on scale bridging problems (both spatial and temporal) in materials and structures. The topics addressed in this invited session include, but are not limited to:

- Homogenization-based methods: mathematical homogenization, computational homogenization etc.
- embedded domain and domain decomposition methods, global-local techniques
- heterogeneous multiscale method (HMM), equation-free method
- (non-equilibrium) thermodynamics-based coarse graining methods
- methods for bridging distinct models, e.g. atomistics-to-continuum
- methods for phenomena with (partially) non-separating scales, e.g. localization, damage and fracture or transient phenomena
- methods for bridging temporal scales
- multiscale methods for coupled multi-field phenomena
- methods for interfaces and contact conditions
- model reduction techniques and reduction of computational costs associated with multiscale algorithms and complex microstructures
- methods for integration of experimental data (e.g. imaging) into multi-scale

numerical algorithms

- data-driven and machine learning based multi-scale approaches
- quantum-assisted solution methods and numerical algorithms