College of Engineering
PEKING UNIVERSITY

Bauhaus-Universität Weimar

Peking University
ES Seminar Series No. 29

COMPUTATIONAL MODELING OF VESICLES IN INTERACTION WITH FLUID FIELD AND ELECTRIC FIELD

The use of electric fields as an external stimulus has been shown to be an effective technique for engineering vesicle behavior in a wide range of biotechnological applications. Electroporation has been successfully utilized for introducing genes or drugs into cells and cancer treatments. As a powerful cell manipulation method, electric fields have been used in tissue ablation, wound healing, and electroformation and electrofusion of giant vesicles. These important applications have motivated theoretical and computational studies on electrohydrodynamics of vesicles in order to gain a better understanding of the variety of membrane responses under the influence of electric and flow fields. In this talk, the work devoted to developing a robust computational framework using isogeometric analysis and the phase-field method to model the morphological evolution of single- and multi-phase biomembranes will be presented. We developed a three-dimensional isogeometric analysis formulation for the phase-field constrained optimization problem of morphological evolution of vesicles in electrical fields. The effect of the flexoelectricity and the conductivity ratio of the electrolyte on vesicle equilibrium shape were studied through several 3D numerical examples. We captured sphere-oblate and sphere-prolate shape transitions under varying conductivity ratio.

26 July, 2023(Wednesday)

9:00 – 10:00 Beijing Time

工学院一号楼210会议室
210 NO.1 BUILDING,
COLLEGE OF ENGINEERING

Prof. Dr.-Ing. Timon Rabczuk

Chair of Computational Mechanics
Bauhaus University Weimar

Prof. Timon Rabczuk, Chair Professor of Computational Mechanics, Head of the Institute of Structural Mechanics at Bauhaus-Weimar University, Member of the European Academy of Sciences, Member of the European Academy of Sciences and Arts, and recipient of the Feodor Lynen Award from Alexander von Humboldt Foundation. His research interests are in computational mechanics, biomechanics, machine learning and computational design of advanced materials. He has been solving problems with high strain rate of materials, explosive impact of protective structures, fluid-solid interaction and design of nano materials. He has been listed as a Global Highly Cited Scholar by ISI Engineering and Computer Science since 2012. He has published more than 700 papers in international journals, attracting over 40,000 citations.

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