36th Colloquium Lecture, School of Mathematics Faculty of Mathematics and Physics

Marie E. Rognes

Simula Research Laboratory

October 14th, 2026, 9:00 am, lecture hall K3

Sokolovská 83, Praha 8 – Karlín

Exciting times: high-fidelity modeling of living tissues

Abstract

Over the last three decades, advances in bioimaging have revolutionized our ability to study the structure and function of living systems. At the nano- to microscale, the new capabilities of cellular microscopy have resulted in the generation and wide availability of large-scale high-resolution imaging data, as strikingly exemplified by increasingly complex dense reconstructions of cortical tissue. In parallel, research in scientific computing and computational mathematics have lead to the development of highly accurate, efficient and scalable numerical algorithms and their realization in open scientific software. In this talk, I will show how we over the last few years have developed high-fidelity computational models of cellular and subcellular physiology, incorporating detailed geometric structure, biophysical dynamics and advanced cell imaging data. I will highlight key numerical challenges - some that we have tackled and some open problems - and point at future directions.

About the speaker

Professor Marie E. Rognes is an internationally recognized researcher in scientific computing, applied mathematics, and mathematical modelling. She serves as Chief Research Scientist at Simula Research Laboratory in Oslo and Deputy Director of the K. G. Jebsen Centre for Brain Fluid Research. Her research combines the analysis and numerical approximation of partial differential equations with applications in neuroscience and biomedicine, leading to important advances in the mathematical understanding of brain fluid transport and related physiological processes. In recognition of her research achievements, Professor Rognes has received several prestigious distinctions, including the 2015 Wilkinson Prize for Numerical Software, the 2018 Royal Norwegian Society of Sciences and Letters Prize for Young Researchers, an ERC Starting Grant, and the 2026 EMS/ECMI Lanczos Prize for Mathematical Software.

Further information
http://msekce.karlin.mff.cuni.cz/colloquia