Charles University
Faculty of Mathematics and Physics

Cordially invites you to

21st Jarník's Lecture

Beyond the incompressible Navier-Stokes equations:

mathematical foundations for flows of non-Newtonian fluids

Given by

Prof. Josef Málek

(Charles University)

On Wednesday, October 5, 2022
at 2 p.m.

In Jarník´s auditorium (M1),
MFF UK
Ke Karlovu 3, Prague 2

The lecture will be also streamed at:
https://cesnet.zoom.us/j/91236696225

Abstract: A century ago mathematicians and theoretical physicists changed the viewpoint regarding the concept of solution to partial differential equations in general, and to the incompressible Navier-Stokes equations in particular. Instead of interpreting the solution to a partial differential equation as a complicated mapping between two sets of variables, they began to view the solution as a point in a suitable infinite-dimensional space. In a landmark paper published in 1934, based on connections between mathematical approaches and the physical underpinnings of the problem, Jean Leray developed a robust mathematical framework for the analysis of solutions to the Navier-Stokes equations in the aforementioned sense. Stimulated by Leray's foundational work, a similar analysis has been since then completed for various systems of nonlinear partial differential equations describing mechanical, thermal, and chemical processes in various materials. In the talk, we briefly introduce non-Newtonian fluids, that is the fluids that cannot be described by the Navier-Stokes equations, and then we discuss recent results regarding the mathematical analysis of the partial differential equations governing the motion of these fluids.

Josef Málek is a Professor at the Faculty of Mathematics and Physics. He is the director of the Nečas Center for Mathematical Modeling and the head of the Department of Mathematical Modeling; the department consists of researchers with diverse backgrounds, and is passionate about education in the graduate study program "Mathematical modeling in science and technology" and the bachelor program „Mathematical modeling". Josef Málek's research approach emphasizes the need for interactions between modeling, analysis, scientific computing, and experiments. He primarily contributed to the analysis of nonlinear partial differential equations in non-Newtonian fluid mechanics and to the development of constitutive theory in fluid and solid mechanics and in the theory of mixtures.