Call for a postdoc position 2025 within the CROP Postdoctoral Fellowship Programme

Project 22	Mathematical Modelling and Numerical Simulation of Flow, Transport and Phase Transitions		
	Faculty of Nuclear Sciences and Physical Engineering	Dept. of Mathematics	https://geraldine.fjfi.cvut.cz
Short description	Investigation of free-boundary problems has been developed during last decades as a consequence of problems solved in physical or biological contexts, achieved advances in material science, space technology and fluid dynamics. Free boundaries are frequently understood as hypersurfaces described by geometrical means, which dynamically evolve due to the driving forces arising in governing partial differential equations. In the project, a class of moving boundary problems will be investigated. It is assumed that such problems are described by the law for the normal velocity of the interface incorporating mean curvature, Gaussian curvature and their differentials. The research in progress is carried out for the problems of pure advection used for fluid-component tracking, for the problems of curvature-dependent evolution up to the problems of surface diffusion. The mentioned problems involve the motion law for the hypersurface or curve together with a conservation law for energy, mass of particular components etc. In this sense, complete analysis of any such problems still remains a challenge. Another area of wide application for moving-fronts algorithms is the simulation of porous-media flow of multiple phases and their transitions. A careful experimental investigation has discovered fingering phenomena accompanying the transport of non-aqueous phase liquids (NAPLs) in the interaction with the wetting phase (usually water). Complicated patterns of the NAPL phase develop during the interaction with pores and other phases, and are a result of the nonlinear behavior of governing equations. The phenomenon can be described by the Hele-Shaw problem for the pressure and position of the phase interface. In case of low influence of capillarity effects, the multi-phase flow is described by a nonlinear conservation law known as Buckley-Leverett problem. Recently, the research interest started to focus on the soil freezing and thawing within the context of climatic changes worldwide where especially the permafrost thaw leading to the release of large amount of gases becomes worth of investigation.		
Supervisor prof. Dr. Ing. Michal Beneš Faculty of Nuclear Sciences and Physical Engineering michal.benes@fjfi.cvut.cz	**Secondment opportunities:** Kanazawa University, Japan 3 months, mathematical analysis a numerical solution of the flow, transport and phase transitions problems **Co-supervisor:** prof. Hirofumi Notsu, Faculty of Mathematics and Physics, Kanazawa University		

Link to the call: https://international.cvut.cz/jobs-at-ctu/crop-postdoctoral-fellowship-programme/