

From the brain to the fuel cell: porous media are everywhere

Presenter: Dr. –Ing Rainer Helmig

Abstract:

Porous media are almost everywhere. The understanding of flow, transport and deformation processes in porous media is important for the optimization of fuel cells, energy storage, the prediction of landslides due to heavy rainfall or the spread of tumors in human tissue. In the context of this lecture, Prof. Rainer Helmig will give a short overview of the importance of porous media and show two specific examples of research applications: multiple sclerosis (modelling and analysis) and the optimization of the fuel cell as a drive technology. What happens in the porous medium "brain" if the blood-brain barrier no longer functions properly? How can research in the field of porous media positively influence the treatment of multiple sclerosis? What role does the understanding about porous media play in the context of alternative mobility forms? What significance does the fuel cell have for our climate as an alternative drive technology? This is where simulations help, because they make the invisible processes in the brain and in the fuel cell visible.



Professor –Ing Rainer Helmig is a full professor at Department of Hydromechanics and Modelling of Hydrosystems, Institute for Modelling Hydraulic and Environmental Systems, University of Stuttgart, Germany. He is also a member of German National Academy of Science and Engineering since 2017.

Dr. Helmig’s research covers groundwater hydrology, multi-phase flow in porous media, numerical modeling, and the analysis of coupled processes between the unsaturated zone and the atmosphere. Special focus is on coupling hydrosystem compartments and complex flow and transport processes, as well as integrating data and models. Emphasis is on fundamental questions about physical and mathematical modeling of multi-phase processes, developing algorithms accounting for fluid phase changes and structural media heterogeneities, thereby forming a basis for various model concepts (e.g. predimensioning decontamination strategies and analyses of energy storage (gas, heat), including their effects on groundwater). Recent research focuses on understanding and modeling mass- and heat-flux processes across the land/atmosphere interface as controlled by dynamic interactions between the atmospheric boundary layer and the land surface.

Dr. Helmig has awarded many awards and the most notable is NOW-von Humboldt Stiftung award in 2012. He obtained B.S. in Civil Engineering from University of Applied Sciences, Münster, and M.S. and Ph.D. degree in Civil Engineering, from University of Hanover.