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Computational Mechanics & Advanced Materials

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SEMINARIO

Flow and transport processes in porous media under model and parameter uncertainty

Flow and transport scenarios in porous media involve a wide range of physical and (geo)chemical processes. The ensuing dynamics span various spatial and temporal scales. Quantifying these processes can be challenging. They are prone to multiple interpretations and can be characterized through sometimes complex mathematical formulations. Even seemingly straightforward flow or chemical transport models can yield surprising outcomes! As we deal with the complexity of process formulation and parameterization, addressing uncertainties becomes critical. For instance, handling spatial heterogeneity of model parameters (such as permeability or porosity) or forcing terms and accounting for limited knowledge of porous medium details still pose significant challenges. In this context, we explore uncertainties related to process/system formulation and parameterization. We do so upon considering their impact on key model outputs of environmental interest such as solute concentrations, source protection regions, and reaction rates. Our discussion encompasses experimental studies, characterization of spatial patterns and instances of porous media heterogeneity characterization, global sensitivity analysis, and stochastic inverse modeling. Critical aspects of uncertainty are discussed through exemplary scenarios. These range from regional to laboratory scales and consider complex aquifer systems, dynamics of a given pharmaceutical product at the typical scale of laboratory studies, and experimental observations of nanoscale mechanistic processes driving dissolution of a mineral subject to reaction under continuous flow conditions. Their analysis enables us to paint a picture of recent advances of fundamental and applied research in the context of flow and transport in porous media under uncertainty.

Prof. Alberto Guadagnini
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22 maggio 2024, ore 14:30 (precise)
Aula MS1, DICAr