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Contribution ID: **31** Type: **Oral Presentation**

On Modeling Nonlinear Flow and Reactive-Diffusion Processes in Heterogeneous Fractured-Porous Media

Wednesday, 2 June 2021 20:20 (15 minutes)

Experimental and theoretical studies indicate that nonlinear dynamical processes are inherent into flow and transport through fractured porous media. However, numerical predictions based on commonly applied numerical models using classical Darcy's, Richards'and Fick's concepts may significantly deviate from real transport processes in porous media. The goal of this paper is to demonstrate an application of several numerical reduced-order models, using systems of partial and ordinary differential equations, for simulations of hydrochemical transport in heterogeneous fractured porous media: (a) Darcy-Brinkman (DB) equation for flow in porous media, given as a system of four ordinary differential equation, including a kinetic component related to fluid velocity, pressure, and gravitational potential, and (b) 1D and 2D Fisher-Kolmogorov-Petrovsky-Piskunov (FKKP) partial differential equations, which are used in chemistry, heat and mass transfer, biology and ecology to describe the coupled diffusion and reaction processes. The results of simulations of the DB equation demonstrate the transition of the flow pattern from steady convection to deterministic chaos and then to randomness. The simulations of the FKPP equation demonstrate how the degree of heterogeneity may change the concentration profile. An application of the Shannon's information entropy shows an asymptotic increase in the degree of complexity of the 2D modeling domain as the number of inclusions increases. The solutions of the fundamental DB and FKPP equations are important to improve our understanding of coupled physical-chemical subsurface processes and interactions in fractured-porous media, relating to petroleum and geothermal studies, environmental management and remediation, mining, gas storage, and radioactive waste isolation in underground repositories.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

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