Short Course on

Multiscale Methods for Multiphase Flow in Porous Media

Hadi Hajibeygi
Assistant Professor at TU Delft, The Netherlands

H.Hajibeygi@tudelft.nl

Description:

The increasing demand for accurate and efficient simulation of flow in subsurface formations motivates development of advanced computational methods. The non-linear, heterogeneous, uncertain, dynamic and coupled nature of the mathematical formulations –describing flow, transport, and reaction– make such developments quite challenging, yet possible if a multiscale methodology is followed. Such a multiscale methodology should allow for a physics-algebraic-based dynamic multilevel description of the highly-resolved heterogeneous discrete equations; at the same time, allow for crossing up and down between any resolutions, and systematic error reduction to any desired level. This short course is offered to enable the attendees to get an in-depth knowledge and implementation skill of the so-called “basis-function-based multiscale methods”, and their extensions to complex rock (e.g., fractures) and fluid physics (e.g., compressibility and compositional). At the end of the course, all participants will develop their own multiscale simulator in Matlab from scratch.

Learning objectives:

1. Formulate sequential simulation of multiphase flow (flow-transport) in porous media
2. Formulate the multiscale procedure for flow:
    - multiscale grids, basis functions, coarse-scale system and interpolation of the fine-scale solution.
3. Develop a 1D MATLAB code for multiscale simulation of flow in heterogeneous porous media.
4. Practice on how multiscale methods can be developed/extended to include complex features including fractures using an Embedded Discrete Fracture Modeling (EDFM) approach.

Course duration: 4-5 December 2017. Participants should bring their own laptops having MATLAB Software installed.