Contribution ID: **336** Type: **Poster (+) Presentation**

Homogenization of two-phase flow in porous media: A diffuse interface approach explaining capillary pressure-staturation hysteresis

Thursday, 3 June 2021 20:00 (1 hour)

Classical models for two-phase flow in porous media are based on a capillary pressure-saturation relationship. Based on the assumption of thermodynamical equilibrium, this relationship is commonly written as $P^n - P^w = P^c(S^w)$, where P^w and P^n denote the fluid pressures of the wetting and non-wetting fluid phases, and P^c is the capillary pressure which depends only on the saturation S^w of the wetting fluid. Prominent examples for this relation for water/gas systems are the parametrisations by Brooks and Corey and by van Genuchten.
However, it is also known for a long time that this approach has some shortcomings (cf. [Hassanizadeh, Gray, Adv. Water Res, 1993] and the references therein). For example, there is hysteresis in P^c–S^w curves obtained for drainage and imbibition. This non-uniqueness is due to the absence of a specific description of the interfacial area (cf. [Joekar-Niasar, Hassanizadeh, Int. J. of Multiphase Flow, 2011] and the references therein).

In this talk we will present a novel upscaling approach for two-phase flow in porous media. We start from a thermodynamically consistent instationary Navier-Stokes-Cahn-Hilliard model describing the evolution of the two-phase flow on the pore scale and identify the relevant time scales. Separating the different scales in the upscaling process allows us derive local fast scale equations describing the microscale dynamics, which are responsible e.g. for hysteresis effects, and global slow scale equations which can be simplified to a generalized macroscopic Darcy law.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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Track Classification: (MS6-A) Physics of multi-phase flow in diverse porous media