Contribution ID: **124** Type: **Oral Presentation**

Stochastic inverse modeling of transient core-scale three-dimensional two-phase flows

Monday, 30 May 2022 14:25 (15 minutes)

We present a computationally efficient methodology for stochastic inverse modeling of transient multi-phase flow at the core scale. We consider the availability of information combining temporal histories of pressure drop across a core sample as well as detailed three-dimensional spatial distributions of oil and brine saturations of the kind that can be observed through in situ X-ray detection.

We study settings associated with an imbibition and a drainage scenario involving brine and a light oil or a heavy oil and bine, respectively. Considering the computational burden associated with stochastic inverse modeling aimed at characterizing the hydraulic attributes of a selected mathematical formulation of two-phase flow, we present a workflow that encompasses (a) stochastic model calibration and (b) global sensitivity analysis.

The workflow starts from a preliminary model calibration focused on identifying a plausible set of model parameters (in term of satisfactory representation of the available information) and a reference value of the objective function. This preliminary step is based on a parameter support space resting on literature data and expert opinion. We then perform a detailed Global Sensitivity Analysis (GSA) of the simulated state variables (core-scale pressure drop and spatial distribution of oil saturation), which encompasses a model behavioral space based on the above mentioned inverse solution. The GSA results enable us to assess the influence of parameter uncertainty on the simulate state variables and (eventually) identify less-influential model parameters. Finally, we perform a stochastic model calibration aimed at obtaining the (conditional) probability density of the model parameters which are deemed as influential on the basis of the GSA, the remaining parameters are fixed to the value rendered by the preliminary model calibration. The ensuing reduction of the dimensionality of the model parameter space yields considerable saving of the overall computational burden.

For both scenarios analyzed we obtain a satisfactory agreement between the numerically simulated pressure drop and saturation distributions and their reference/observed counterparts. We then discuss the key traits of the obtained parameter distributions upon relating these to the behavior of the system, as encapsulated in the employed model formulation.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

Italy

References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

Primary authors: MANZONI, Andrea (Politecnico di Milano); GUADAGNINI, Alberto (Politecnico di Milano); DELL'OCA, Aronne (politecnico di milano); SIENA, Martina (Politecnico di Milano)

Presenter: MANZONI, Andrea (Politecnico di Milano)

Session Classification: MS06-B

Track Classification: (MS06-B) Interfacial phenomena in multiphase systems