

# Disorder characterization of porous media and its effect on fluid displacement

\*Zhongzheng Wang<sup>1</sup>, Kapil Chauhan<sup>1</sup>, Jean-Michel Pereira<sup>2</sup>, and †Yixiang Gan<sup>1</sup>

<sup>1</sup>School of Civil Engineering, The University of Sydney, Australia.

<sup>2</sup>Laboratoire Navier, UMR 8205, Ecole des Ponts ParisTech, France.

\*Presenting author: zhongzheng.wang@sydney.edu.au

†Corresponding author: yixiang.gan@sydney.edu.au

## Abstract

We investigate the effects of topological disorder and wettability on fluid displacement in porous media. A modified disorder index  $I_v$  is proposed to characterize the disorder of porous media. By changing  $I_v$ , different displacement patterns (stable displacement and fingering) under the same flow condition and fluid property are obtained. We analytically demonstrate how increase in disorder promotes fingering due to uneven distribution of local capillary pressure. It is shown that the displacement efficiency for different wettability conditions and disorder well correlates with the distribution of local capillary pressure. A power law relation between fluid-fluid interfacial length and saturation of invading fluid is proposed by taking geometry into account, where the parameters in power law relation can be predicted by the capillary index,  $I_c$ , unifying the effects of topological disorder and wettability.

**Keywords:** Disorder, Fingering, Porous media, Interface, Lattice Boltzmann Method, Displacement efficiency, Wettability.