In-depth description of the methodology applied on *PORE (scientific software for reservoir characterization with pore network extraction)*

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We present an in-depth description of the methodology employed by *PORE*, a scientific software for reservoir characterization based on pore network extraction from rock samples tomographies. Network extraction, single and multi-phase flow models are discussed. Pore-network methodology consists in creating an equivalent structure that can preserve the original porous structure connectivity, but with simplified geometry. The network is segmented in two types of elements: Pores - representing the larger porous of the rock, and throats - channels connecting pores.

Pore and throat bodies are approximated by prismatic objects that incorporate irregularities of the original geometries, and are able to hold immiscible fluids in their corners due to capillary forces and wettability effects. Four different cross section shapes are used (circle, square, equilateral and scalene triangles), depending on the shape factor of the original form.

Once the network is extracted, a series of analysis can be performed: statistical distribution of pore sizes, coordination number, etc. Flow simulation model is inspired on the methodology presented by Blunt et al., Øren et al. and Valvatne (1998; 2002; 2004).

The method makes use of the simplified geometry of the network elements ~~that use~~in order to apply ~~-~~well-known expressions for flows between pores (Poiseulle generalized equation for flow in the interior of prismatic ducts). Flow equations coupled with mass conservation ~~can~~ will assemble a representative ~~complex~~ hydraulic system. Hydraulic resistance is captured from the original structure by applying the appropriate cross section shape to that element. At the end, an overall flow resistance of the sample is captured. This methodology requires less computational resources in comparison to alternatives such as Lattice-Boltzmann methods, and produces results with good accordance to experimental results. As a bonus, this approach allows the extension of the presented method to perform multi-scale analysis by generating combined networks extracted from images with different resolutions.

While single-phase flow model is able to bring absolute permeability predictions for the rock sample, two-phase flow model allows simulation of primary drainage and subsequent imbibition, providing results for capillary pressure, relative permeability, irreducible water saturation and residual oil saturation.

KEYWORDS: PORE-NETWORK EXTRACTION; IMAGE ANALYSIS; RESERVOIR CHARACTERIZATION, DIGITAL ROCK

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Comentado [Tadeu1]: Frase tava muito grande, tentei simplificar um pouco

Comentado [LPR2]: Não é melhor manter tudo no presente?

Comentado [Tadeu3]: Os poros também são prismáticos? Não são esferas sempre? Essa frase não seria só sobre as throats?

Comentado [Tadeu4]: The definition of "prismatic" is "constant cross section shape"

Comentado [LPR5]: Esta sentença não tem verbo e acho que pode ser conectada melhor a sentença anterior. Favor revisar.

Comentado [Tadeu6]: Não é melhor listar todas as análises que podem ser feitas? No "etc." aqui não é muito óbvio o que mais pode ser feito.