Building a Pore Network Model from a Pore Space 3D Image to Precisely Predict Permeability Tensor

D. Bernard[1], N. Combaret[2], and E. Plougonven[3]

[1]*CNRS, Université de Bordeaux, ICMCB, Pessac, France*
[2]*Formely CNRS, Université de Bordeaux, ICMCB; Presently VSG, Visualization Sciences Group, Mérignac, France*
[3]*Formely CNRS, Université de Bordeaux, ICMCB; Presently Université de Liège, département de chimie appliquée, Liège, Belgium*

ABSTRACT:

Pore network models (PNM) are widely used for more than 50 years to study pore scale transports. It is commonly admitted that, in order to give realistic property predictions, the PNM must summarize all the relevant topological and geometrical aspects of the considered porous medium. Now that 3D imaging techniques give us very precise representations of this geometry, it is difficult to state that most of the PNM, which are based on regular cubic lattices, are representative of the pore space. But, even if 3D images are easy to obtain, the construction of a representative PNM only using information directly extracted from the 3D images is still difficult.
In this work we present a methodology for such a construction. Starting from a 3D binary image of a porous sample, all the crucial steps of the method are analysed in depth. Permeability values obtained by our PMN are compared to values obtained by direct numerical modeling where Stokes equations are solved using the voxelized 3D image as computation grid.
An extension of the model allowing computing the full permeability tensor is also presented.