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# Intercomparison of the pore network to Navier-Stokes modelling approach used for saturated conductivity estimation from X-ray CT images

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Different modelling techniques could be used for estimation of the conductivity based on CT images. In this research three methods are intercompared: direct modelling using Navier-Stokes (NS) approach; simplified geometry pore-network (PN) approach and estimation by Kozeny-Carman (KC) equation. All of above-mentioned modelling approaches rely on the same input information – geometry of the pore medium but use it differently: NS is using real geometry for modelling while PN rely on the simplified pore-space model – pore network – build up from spherical pores and cylindrical throats. Contrary to NS and PN approaches KC estimation is based only on two global measures of the pore-space: total porosity and specific surface. Estimation of the saturated conductivity using all three methods is made for 20 samples prepared from sand material with diverse particle size distribution. As a material for samples different intact and milled sand fractions were used. Samples were scanned using X-ray CT device with voxel size 2um. After filtering CT images were thresholded and then numerical mesh (for NS modelling) and pore-networks (for PN modelling) were generated. Saturated conductivity was estimated using all three methods and results were compared. PN estimated saturated conductivity was found to be statistically equivalent to NS determined saturated conductivity values. The average value of the PN determined to NS determined conductivity ratio (KsatPN/NS) was equal to 0.927. Kozeny-Carman equation-based estimation overestimated saturated conductivity more than twice (2.624) in relation to NS estimations (KsatKC/NS). The dependence between pore media specific surface and KsatPN/NS and KsatKC/NS ratios was observed. In case of Kozeny-Carman estimation this dependence was caused by the pore media tortuosity changes with specific surface.

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