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DOWNSCALING: FINE-SCALE CONDUCTIVITY IDENTIFICATION BY INVERSE MODELLING

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Summary. Determination of conductivities from either measured or computed head – flow rate pairs is performed by an inverse modelling approach. Downscaling, in turn, is an inverse modelling technique applied for determining fine-scale conductivities in coarse-scale grid blocks, in such a way that the boundary conditions arising from a coarse-scale model are taken into account at the fine-scale. In this sense, the downscaling procedures may be considered as a practical complement to those of upscaling.

Unlike in the applications aiming at detecting the shape of a body based on different conductivity properties, our main interest is to determine a global heterogeneous field ensuring consistency of boundary conditions. To this end we apply the Double Constraint method. This iterative method is based on the Electrical Impedance Tomography approach. The reported computational examples present applications in the case of far-field downscaling. Finite elements are used for discretization. We base our computational experiments on randomly generated initial conductivity patterns.

This work is a continuation of ideas presented in [1,2].

[1] G.K. Brouwer, P.A. Fokker, F. Wilschut, W. Zijl, "A direct inverse model to determine permeability fields from pressure and flow rate measurements", *Math. Geosci.,* **40**, 907-920 (2008).
[2] A. Trykozko, G. Brouwer, W. Zijl, "Downscaling – a complement to homogenization", *Int. Journ. Of. Num. Analysis and Modeling*, **5**, Supp, 157-170 (2008).