ESTIMATION OF FLUID FLOW IN UNSATURATED POROUS MEDIUM

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We consider the estimation of electrically conductive fluid flow in porous media with unknown material parameter distribution. The inversion problem is formulated as a state estimation problem. The approach is based on an evolution-observation model and is solved using an extended Kalman filter algorithm. The example we consider involves the imaging of time-varying distributions of water saturation in porous media using time-lapse electrical resistance tomography (ERT). The complete electrode model with Archie's law relating saturations to electrical conductivity is used as the observation model. The evolution model we employ is a simplified (approximate) model for simulating flow through partially saturated porous media. Since the material parameters are not known, the evolution model is not completely specified and a statistical model for the disrepancy has to be constructed. This model can be realized using the nonstationary extension of the approximation error approach.