



The prediction and identification problems for hysteretic multiphase porous media - an exploration of methods using a simple differential equation

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Multiphase porous media such as soils are known to exhibit hysteresis, e.g. in soils there is a strong hysteretic relationship between the moisture content and the matric potential. We have previously modeled hysteretic flows through soils with a nonlinear, first order ordinary differential equation with a Preisach operator. Where the Preisach operator is a mathematical tool ideally suited for modelling rate-independent hysteresis. We present the results of three cases.

1. The prediction problem: given selected input functions, the parameters of the hysteretic differential equation (HDE) and its past history, we calculate the future output.
2. The inverse problem: we identify the "unknown" parameters describing this system from a "perfect" input/output time series.
3. The inverse problem with "imperfect" data: The "perfect" input/output data from (2) is corrupted with systematic and random error and we again identify the "unknown" parameters. We constrain the search space since inverse problems are known to be ill-posed.