# Multiple-network poroelastic Systems: Stable Parameter-Robust Preconditioners

Q Hong, J Kraus, M Lymbery, F Philo

## Abstract

Multiple-network poroelastic theory (MPET) generalizes Biot's consolidation model. It describes a mechanical deformation and fluid flow in porous media permeated by multiple fluid networks of pores and fissures with differing porosity and permeability.
The diversity of phenomena to which the MPET model can be applied suggests that the parameters of the governing system of partial differential equations can vary over several orders of magnitude which makes its stable discretization and efficient solution a challenging task.
In this work the methodology presented by Hong and Kraus [Parameter-robust stability of classical three-field formulation of Biot's consolidation model. Electronic Transactions on Numerical Analysis 48, 202-226, 2018] is further developed to show the uniform inf-sup stability of the weak formulation of the MPET equations using proper parameter-dependent norms. Furthermore, the transfer of the canonical norm-equivalent operator preconditioners from the continuous to the discrete level facilitates the construction of optimal and fully robust iterative solution methods. This project is joint work with Qingguo Hong (Penn State University, USA), Johannes Kraus ( Universtiy of Duisburg-Essen, Germany ) and Maria Lymbery ( Universtiy of Duisburg-Essen, Germany ).