

## Preconditioned Solution of the Coupled Stokes-Darcy Flow Problem

Prince Chidyagwai (Loyola University, Baltimore),  
Scott Ladenheim, and Daniel B. Szyld.  
(Temple University, Philadelphia)

We consider the numerical description of the coupled Stokes-Darcy flow, i.e., of flow where one part of the domain is governed by a Stokes flow, and the other corresponds to porous media flow, along with coupling conditions on the interface.

We propose the use of a constraint preconditioner for this problem. We provide spectral bounds for the preconditioned problems, which are independent of the size of the finite element mesh. We use both standard (continuous) finite elements for both flows, and also consider the case where the porous media flow is modeled with Discontinuous Galerkin methods. Numerical experiments in two and three dimensions, illustrate our results, and comparisons with other saddle-point preconditioners found in the literature demonstrate the advantage of our approach.

Keywords: Stokes-Darcy flow. Constraint preconditioner.  
Indefinite preconditioner.  
Spectral equivalence.