1135-65-1329 **Prince Chidyagwai*** (pchidyagwai@loyola.edu), Loyola University Maryland, Department of Mathematics and Statistics, 4501 N. Charles Street, Baltimore, MD 21210. *A multirate decoupling scheme for transient coupled surface-subsurface flows.*

We present a multi-rate decoupling scheme for solving the time dependent coupled free flow with porous media flow problem. The flow is modelled by the coupled (Stokes/Navier–Stokes) – Darcy system with appropriate interface conditions. We discretize in space using a multi-numerics scheme combing the continuous finite element method in the free flow region and the discontinuous Galerkin method in the porous medium. This choice of finite element spaces is due to the discontinuities that are typical in the permeability of the porous medium. The fully discrete problem yields large fully coupled problems that must be solved at each time step. This can be computationally expensive, therefore we propose a decoupling technique that takes advantage of the slow moving flow in the porous medium relative to the free flow. This allows the use of larger time steps in the porous domain compared to the free flow domain. The decoupling is attained by time-lagging unknowns on the interface. We present stability and convergence analysis of the decoupling scheme. We compare the fully coupled scheme to the multi-rate decoupling scheme in terms of CPU time and accuracy and demonstrate the stability and robustness of the scheme with respect to realistic physical parameters. (Received September 21, 2017)