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Wenbin Chen (wbchen@fudan.edu.cn), **Max Gunzburger** (gunzburg@fsu.edu), **Dong Sun*** (dsun@math.fsu.edu) and **Xiaoming Wang** (wxm@math.fsu.edu). *One Type of Efficient and Long-Time Accurate Third-Order Method for the Stokes-Darcy System.*

We propose and study one type of third-order in time implicit-explicit (IMEX) method for the coupled Stokes-Darcy system, which is commonly used in the modeling of the flow in karst aquifers and other subsurface flows. The method is a combination of the third-order Adams-Moulton and third-order Adams-Bashforth methods. Although the model is coupled on the continuous level, the numerical algorithm is fully-decoupled, i.e., we only need to solve a decoupled Stokes equation and a decoupled Darcy equation at each time step. Therefore, the scheme is very efficient, and can be computed in a parallel fashion using legacy codes. The unconditional and uniform in time stability for the scheme is proved. The uniform in time stability provides uniform in time control of the error which is very important for many physical processes that happens over a large period of time, e.g., contaminant accumulation and transport. Error estimate for the semi-discretized scheme is derived. Numerical examples are tested to illustrate the accuracy, efficiency, and long-time stability of the the scheme. (Received September 16, 2014)