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Enriched Galerkin approach for density-driven flow in unsaturated coastal aquifer

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Accurate numerical simulations for density-dependent flow and transport model is one of the crucial keys for successful water resources management in coastal areas and on islands. However, traditional modeling approaches without special treatment may not be able to resolve accurate sharp moving fronts and corresponding groundwater flow velocities due to the numerical instabilities.

In this presentation, we employ the enriched Galerkin finite element methods (EG), which enriches a classical continuous Galerkin finite element methods with piecewise constant functions to ensure local and global mass conservation. EG has the same bilinear forms as the discontinuous Galerkin (DG) finite element methods but EG has fewer degrees of freedom in comparison with DG. Moreover, dynamic mesh adaptivity approaches are employed to save computational cost for realistic large-scale problems and an efficient Krylov solver with preconditioner is provided. We will present initial numerical results for existing benchmark problems to show efficiency and effectiveness of the proposed method in density-driven flow modeling.

References

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Primary author: LEE, Jonghyun (University of Hawaii at Manoa)

Co-author: Prof. LEE, Sanghyun (Department of Mathematics, Florida State University)

Presenter: LEE, Jonghyun (University of Hawaii at Manoa)

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