

A fast algorithm to compute flow ensembles

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Abstract Repeated computations of flow equations with varying parameters are commonly seen in many engineering and geophysical applications as an effort to deal with inherent uncertainties. These computations are generally treated as independent tasks. While parallel computing can save computational time in this setting, no savings are realized in terms of total computational cost. In this talk, we will describe a new way to perform multiple simulations efficiently, in terms of both storage and computational cost. The proposed algorithm computes all realizations at one pass by adopting an ensemble time-stepping scheme, which results in the same coefficient matrix for all realizations. This reduces the problem of solving multiple linear systems to solving one linear system with multiple right-hand sides, for which many efficient methods, e.g., block CG, block QMR, block GMRES, have been developed to significantly save the computation cost.

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