HACETTEPE ÜNİVERSİTESİ MATEMATİK BÖLÜMÜ GENEL SEMİNERİ

(HACETTEPE UNIVERSITY MATHEMATICS GENERAL SEMINAR)

Tarih (Date): 13.03.2019, Çarşamba (Wednesday)

Saat (Time): 15:00

Yer (Place): Yaşar Ataman Seminer Salonu

Konuşmacı (Speaker): Öğr. Gör. Dr. Mustafa Ağgül

Başlık (Title): A Defect-Deferred Correction Method for Fluid-Fluid Interaction

Özet (Abstract): A method is proposed to improve two aspects of numerical simulations for a model of two fluids coupled across a flat interface. This problem is motivated by atmosphere-ocean interaction. A deferred correction approach lifts the numerical order of accuracy formally from first order (very common in applications) to second order in terms of the time interval of communication between the fluid code components. This is accomplished in a two-step predictor-corrector-type method. In the second step, a further defect correction is included as well. The “defect” represents artificial diffusion used in the fluid solvers, which is often included to control numerical noise or to model subscale mixing processes. The addition of the defect correction adds only marginally to the expense, but in exchange may provide a significant reduction of overdiffusive effects. The defect and deferred correction approaches are combined into a so-called defect-deferred correction (DDC) method. A full DDC algorithm is studied using finite elements in space, including an analysis of the stability and convergence. The method is unconditionally stable and optimally convergent, and also enforces a formal reduction in artificial diffusion effects. A computational example using a known (manufactured) solution illustrates the theoretical predictions. We observe a computational benefit in this example even for coarse time steps and over a wide range of artificial viscosity values. Some discussion is provided regarding the possibility to generalize the approach for application codes. Briefly, legacy atmosphere and ocean codes may be used as-is over a coupling time interval for a predictor computation. The corrector step would then potentially be implemented as a straightforward modification of the predictor step that leverages the existing code structure.