# On multiscale ADI methods for parabolic PDEs with a discontinuous coefficient

**Zhilin Li**

**Department of Mathematics, North Carolina State University, USA**

**Email: zhilin@math.ncsu.edu**

The ADI (alternating direction implicit) method is one of the most efficient methods in solving parabolic PDEs of initial and boundary value problems. However, it is challenging to develop efficient ADI methods if the coefficient of a PDE has multiscale or discontinuities. In this talk, several ADI methods based on augmented approaches are studied. The introduced augmented variable along the interface enables us to get dimension by dimension jump conditions in a scale needed to get accurate discretization in the coordinate directions. Three different ADI methods, their advantages and limitations, and the stability are discussed. With the new ADI methods, not only the computed solution is second order accurate globally in the maximum norm, but also is the augmented variable that is related to the gradient of the solution from each side of the interface. One of the ADI methods seems to be unconditionally stable. The accuracy and efficiency of the ADI methods are validated through various examples. An application example with complicated and multi-connected interfaces is also presented.