MAREK STASTNA, University of Waterloo
Numerical Simulation of Confined Shear Instability

The transition from laminar to turbulent flow via shear instability is one of the most widely studied problems in fluid mechanics. Beginning with the linear stability theory as encapsulated in the Taylor Goldstein equation, through analysis of secondary instability in the resulting billows and finishing in simulations of the complex, turbulent flow that results, the basic scenario is well understood. Experimentally, the classical tilted tube experiments due to Thorpe have demonstrated both the general validity of the theory and the rich, and complex phenomenology the physical world exhibits. In this talk I will revisit the shear transition using a pseudospectral numerical methodology that allows for the resolution of both the primary shear instability and the boundary layers on the confining walls. I will demonstrate how, and in what parameter regime, the presence of walls quenches three-dimensionalization. In cases where three dimensionalization does occur I will discuss how vorticity is removed from the boundary layer, and during which portion of the instability the shear stresses on the wall reach their maximum value. Finally, I will briefly speculate on the implications of these simulations for the issue of sediment resuspension by boundary layer instabilities.