1143-35-110 **Weiwei Hu*** (weiwei.hu@okstate.edu), 416 Math Science Building, Dept. of Math., Oklahoma State University, Stillwater, OK 74078. *Boundary Control of Optimal Mixing via Fluid Flows.*

We discuss the problem of optimal mixing of an inhomogeneous distribution of a scalar field via an active control of the flow velocity, governed by Stokes or Navier-Stokes equations, in a two dimensional open bounded and connected domain. We consider the velocity field steered by a control input that acts tangentially on the boundary of the domain through the Navier slip boundary conditions. This is motivated by the problem of mixing within a cavity or vessel by moving the walls or stirring at the boundaries. Our main objective is to design an optimal Navier slip boundary control that optimizes mixing at a given final time. Non-dissipative scalars, both passive and active, governed by the transport equation will be discussed. In the absence of diffusion, transport and mixing occur due to pure advection. This essentially leads to a nonlinear control problem of a semi-dissipative system. A rigorous proof of the existence of an optimal controller and the first-order necessary conditions for optimality will be presented. (Received August 03, 2018)