

CRUNCH Seminars at Brown, Division of Applied Mathematics

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Optimal Control of momentum and scalar transfer

~ Turbulence control, shape/topology optimization, remodeling of vascular network ~

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Control of fluid flow and associated heat and mass transfer is a key for energy savings and improvement of efficiencies in various energy devices. In this talk, we introduce our recent activities for enhancing heat transfer (or mixing) with minimum pumping power. This is quite challenging considering that there exists strong similarity between momentum and scalar transfer, which is widely known as the Reynolds analogy. We will first show that optimal control theory is a powerful tool for simultaneous achievement of drag reduction and heat transfer enhancement, and then extend it to shape/topology optimization. Finally, we will also discuss an example of topology optimization in a biological system, i.e., remodeling of vascular network