Inverse Shape Problems about the Effective Burning Rate Function in a Turbulent Convection Model

Wenjia Jing

Yau Mathematical Sciences Center, Tsinghua University, China

Email: wjjing@tsinghua.edu.cn

Front propagation phenomena with multi-scale convecting velocity appear very often in applied sciences, namely in turbulent combustion and ecological applications. It is important to understand such front propagations viewed at large scales. Majda and Souganidis started with a reaction-diffusion-convection equation with periodic multi-scale convecting velocity, and developed a mathematically rigorous theory that captures the large scale geometric propagation of the fronts. In particular, the effective burning rate function is obtained through a minimization that involves the effective Hamiltonian, the latter coming from the cell problem of an underlying Hamilton-Jacobi equation. In this talk I will present some results of inverse shape type: if the effective burning rate function is isotropic, what can one say about the micro-scale convecting velocity? what does it imply if the level set of this function has flat pieces, etc. This talk is based on a joint work with Hung V. Tran and Yifeng Yu.