Fluid Flow and Enhanced Dissipation in Heat Equation

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Abstract

I will discuss recent results on the influence of fluid flow on diffusion and reaction in the context of reaction-diffusion equations. We consider different classes of flows and prove estimates on the fundamental solutions of the advection-diffusion equation which take into account flow strength and structure. Although the questions we pose are quite natural and simple, mathematical methods needed can be fairly subtle. We use PDE estimates, probabilistic tools (such as Malliavin calculus) and spectral theory techniques. In particular, RAGE theorem helps in finding sharp descripiton of a class of flows leading to enhanced dissipation on a torus.