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The Hong Kong University of Science and Technology

Department of Mathematics

Seminar on PDE

Results motivated by the study of the evolution of isolated vortex lines for 3D Euler

By

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Abstract

In the study of an isolated vortex line for 3D Euler one is trying to make sense of the evolution of a curve, where the vorticity (a distribution in this case) is supported, and tangential to the curve. This idealised vorticity generates a velocity field that is too singular (like the inverse of the distance to the curve and therefore not in L^2) and making rigorous sense of the evolution of the curve remains a fundamental problem.

In the talk I will present examples of simple globally divergence-free velocity fields for which an initial delta function in one point (in 2D, with analogous results in 3D) becomes a delta supported on a set of Hausdorff dimension 2. In this examples the velocity does not correspond to an active scalar equation.

I will also present a construction of an active scalar equation in 2D, with a milder singularity than that present in Euler for which there exists an initial data given by a point delta becomes a one dimensional set. These results are joint with C. Fefferman and B. Pooley.

These are examples in which we have non-uniqueness for the evolution of a singular "vorticity". For the Surface Quasi-Geostrophic equation, an equation with great similarities with 3D Euler, the evolution of a sharp front is the analogous scenario to a vortex line for 3D Euler. I will describe a geometric construction using "almost-sharp" fronts than ensure the evolution according to the equation derived heuristically. This part is joint work with C. Fefferman.

Date: **Friday, 14 June 2019**

Time: **2:00p.m. - 3:00p.m.**

Venue: **Room 3472, Academic Building (near Lifts 25 - 26), HKUST**

All are welcome!