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The Navier-Stokes equation on the whole plane with time-dependent external forces

Masao Yamazaki
Faculty of Science and Engineering, Waseda University

This talk is concerned with the Navier-Stokes equation on the whole plane with external force depending on time variable and not decaying as time tends to infinite. Typical examples are time-periodic external forces and external forces almost periodic in time. Recently, problems of this type are well-studied for dimensions three or more, but little is known for two-dimensional unbounded domains.

In this talk we assume that the external force satisfies some symmetry and is small in suitable function spaces, and show the unique existence of a small solution of the problem above. In particular, if the external force is periodic or almost periodic in time, then the solution is shown to be periodic with the same period or almost peridic.

The proof is based on the fixed point argument. We obtain main estimate by regarding the Gauss kernel as a Fourier multiplier, and employ its boundedness on weighted L^q-spaces. Besides, in order to treat the external force satisfying critical decay condition, we employ real interpolation with sublinear operators.