Seminário de sistemas dinâmicos e estocásticos

Departamento de Matemática - IMECC - UNICAMP

A probabilistic study of the vanishing viscosity limit in the Fractal Burgers Equation

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Resumo:

Nowadays it is being popular the use of the nonlocal PDEs (Partial Differential Equations) models in Physics to capture effects of interaction between particles that are not neighbours and to express the non-isotropic transfer of the energy in the state space. One of the Fields which these kind of models are relevant is Fluid Dynamics and it appears as a toy model to understand the motion of a fluid with nonlocal sources of interaction the Fractal Burgers Equation:

$$\partial_t u + < u, \nabla u > + \nu(-\Delta u)^\alpha + f(t, x, u, \nabla u, u(t, \beta(x,\ )) - u(t, x)) = 0 \qquad (1)$$

being ν the viscosity of the fluid, β a displacement of the position and f an semilinear term performing an external force in the fluid.

Using probabilistic arguments it is our intention to study the stability of the equation when the viscosity of the fluid goes to 0, $\nu \to 0$.

We associate to this equation with a terminal condition a FBSDE (Forward-Backward Sto- chastic Differential Equation) and perform the asymptotic study using its formulation. As a probabilistic counterpart we obtain in a natural way a Large Deviations Principle to the laws of the forward and backward processes associated to our equation. We present some general notions about the stochastic tool used (FBSDEs) in the way to familiarize the audience that has not contact with this subject and show main ideas about connections of FBSDEs and PDEs and in order to understand the strategy used to study the problem above.

References

[1] G. Barles, R. Buckdahn, E. Pardoux, Backward Stochastic Differential Equations and Integral-Partial Differential Equations, Stochastic and Stochastic Reports, vol. 60, 57-83, 1997

[2] A. B. Cruzeiro, A.O.G., L. Zhang, Asymptotic Properties of Coupled Forward Backward Stochastic Differential Equations, Stochastic and Dynamics, vol no. 14, Issue no. 3

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