

学术报告

报告题目: Stochastic methods in computational fluid dynamics and turbulence

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报告摘要: In these talks I am going to present a small part of the science suggested in the title, and I aim to cover some ideas of applying stochastic calculus to Computational Fluid Dynamics (CFD) which are developed recently by various authors including some of my co-authors and myself: Prof. Endre Süli (Oxford), Prof. Youchun Qiu (Toulouse, France), Prof. Jianglun Wu (Swansea), Prof. Mingyu Xu (Fudan), Dr Jiawei Li (Edinburgh), Mr Yihuang Zhang (Oxford Dphil student), based on the following papers:

1. Tracking the vortex motion by using Brownian fluid particles, Phys. Fluids 33, 105113 (2021).
2. McKean - Vlasov type stochastic differential equations arising from the random vortex method. Partial Differential Equations and Applications (2022) 3:7
3. Random vortex dynamics via functional stochastic differential equations. Proc. R. Soc. A 478: 20220030.
4. <https://arxiv.org/pdf/2206.05198.pdf>
5. <https://arxiv.org/pdf/2303.17260.pdf>

Lecture 1: In this talk I will explain the idea how to formulate (incompressible) fluid dynamic equations into McKean-Vlasov type mean field equations, and outline some Mathematical questions which may be worthy to explore. As an example, I will present a new method for solving a related McKean-Vlasov SDEs by means of weak solution method.

Lecture 2: In this talk I will first establish the duality of conditional laws among diffusion processes associated with solenoidal vector fields, and establish new functional integral representation theorem for a class of linear (but temporal non-homogeneous) parabolic equations. Finally we apply the new representation theorem for the study of incompressible fluid flows past a solid wall.