

2022 AUSTRALASIAN FLUID MECHANICS SEMINAR SERIES

SWIRLING ELECTROLYTE: DECEPTIVE SIMPLICITY

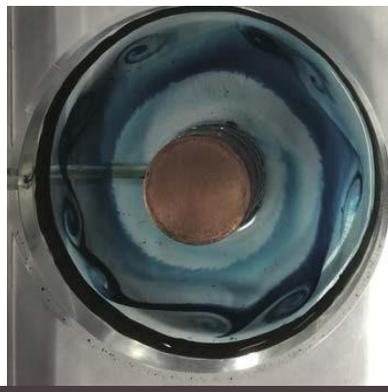
PROF. SERGEY SUSLOV (SWINBURNE UNIVERSITY OF TECHNOLOGY)

WEDNESDAY 24 AUGUST 2022 (4:00PM AEST)

ZOOM: [LINK ID: 861 3567 8077 PWD: 757954](#)

Abstract: In this talk, I will discuss a flow of an electrolyte in a shallow annular layer, a typical setup used in physical modelling of hurricanes and in various electromagnetic stirring applications. The fluid motion is caused by an azimuthally acting Lorentz force appearing when a radial current passes through the electrolyte layer placed on top of a magnet with a vertical polarisation. A small electrolyte depth and the circumferential direction of the driving force suggest that the flow in such a system should be essentially uni-directional and could be described by approximate quasi-two-dimensional equations. Surprisingly, not only the flow is fully three-dimensional, but also multiple flow solutions exist for the same set of governing parameters. Their stability analysis reveals that only one of such solutions leads to the appearance of azimuthally periodic vortex patterns observed in experiments. However, this solution "disappears" via a saddle-node bifurcation removing the necessary condition for vortex instability while it is still observed experimentally. A further analysis undertaken to resolve this apparent contradiction reveals even more intricate features, topology and physical mechanisms driving such a deceptively simple flow that distinguish it drastically from its counterparts studied in very similar geometries previously.

Bio: Sergey Suslov is Professor of Applied Mathematics at Swinburne University of Technology. He obtained his major education and his first Master of Science degree in Applied Mathematics and Physics from Moscow Institute of Physics and Technology in Russia and was subsequently awarded his second Master of Science degree and PhD from the University of Notre Dame, USA in 1997. He moved to Australia as an ARC Postdoctoral Research Fellow shortly after. Subsequently, he took up an academic position in the Department of Mathematics and Computing at the University of Southern Queensland, where he later became the Head of Mathematics Discipline. He then joined Swinburne University of Technology in 2008. He is currently an editor of "Mathematical Problems in Engineering". During his research career he authored and co-authored more than 100 refereed publications in major journals and conference proceedings and won several academic awards for excellence in fluid mechanics. He supervised and co-supervised to successful completion more than 10 PhD students. His major research interests are in hydrodynamic stability theory of flows arising in various physical applications including flows of non-Boussinesq, piezo-viscous, magnetic and electrically conducting fluids. Currently, he is also involved in a large NSF (USA) funded project investigating ocean spray influence on the dynamics of tropical cyclones.



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