DANISH CENTER FOR APPLIED MATHEMATICS AND MECHANICS

The 2014 DCAMM Annual Seminar Speaker

GertJan van Heijst

Professor
Department of Physics
Eindhoven University of Technology
The Netherlands

gives the following lecture in Kgs. Lyngby and Aarhus

The behavior of vortex structures near solid obstacles

Monday, December 8, at 14:00

Technical University of Denmark
Meeting Room 1, Building 101, Kgs. Lyngby

There will be an open discussion after the lecture at 15:00 where refreshments are served

Tuesday, December 9, at 14:00

Aarhus University
Auditorium 01.078, Dept. of Engineering,
Inge Lehmanns Gade 10, Aarhus

There will be an open discussion after the lecture at 15:00 where refreshments are served

This lecture aims at popularizing mechanical science to a broad audience of interested students and staff as well as engineers working in industry

The Danish Centre for Applied Mathematics and Mechanics, DCAMM, is a framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark, Aalborg University, Aarhus University and University of Southern Denmark. The "DCAMM Annual Seminar Speaker" is an initiative created to disseminate mechanics to a broader audience. *For further information on DCAMM, see www.dcamm.dk*

DTU AALBORG UNIVERSITET AARHUS UNIVERSITY UNIVERSITY OF SOUTHERN DENMARK

The 2014 DCAMM Annual Seminar Speaker

GertJan van Heijst

Professor
Department of Physics
Eindhoven University of Technology
The Netherlands

The behaviour of vortex structures near solid obstacles

Abstract

Two-dimensional turbulence is characterized by the inverse energy cascade, which results in self-organisation of the flow, as seen in the emergence of coherent vortex structures. These coherent flow structures may take the form of monopolar or dipolar vortices, and even a tripolar vortex has been found. The lecture will provide an overview of the basic dynamical features of two-dimensional turbulence, and in particular highlight the role of solid boundaries on the flow evolution.
A special point of attention is the behaviour of vortex structures near solid obstacles in the flow domain. We will address the problem of a dipolar vortex approaching solid objects like a cylinder, a row of closely positioned cylinders, or a sharp-edged plate. Vorticity generated at the no-slip surface of the obstacle or due to flow separation at sharp edges is advected away from the wall and may thus interact with the primary vortex structure. This may lead to very complicated behaviour, like splitting and partial rebound of the primary dipole.
Laboratory experiments have been performed in a rotating fluid tank, the background rotation providing a mechanism for making the relative flow approximately two-dimensional. The flow evolution has been visualized by adding dye, while quantitative information about the vorticity distribution was obtained by PIV measurements. In addition to numerical flow simulations, some analytical studies have been carried out, which provide important information about the vortex-wall interaction.

DTU AALBORG UNIVERSITET AARHUS UNIVERSITY UNIVERSITY OF SOUTHERN DENMARK