

Prof. Tim Colonius

California Institute of Technology, Pasadena, California, USA

will present a seminar for our group Engineering Fluid Dynamics with title:

Leading-edge vortex in unsteady aerodynamics at low Reynolds number

Date: Tuesday December 15, 2015

Time: 10:45

Location: Horst HT500B

Summary

An immersed boundary method is used to solve the incompressible Navier-Stokes equations for flows over two- and three-dimensional wings at low Reynolds number. Apart from their interest for insect flight and micro-air vehicles, these flows are fast to compute and consequently unsteady airfoil motions can be studied over a large parameter space. We focus on the dynamics of the leading-edge vortex (LEV) that plays an important role in determining mean and fluctuating forces in unsteady flows at high angle of attack. We consider canonical surging and plunging airfoil motions, as well as rotating wings relevant to vertical-axis wind turbines. The phase between the LEV pinch off and the unsteady airfoil motion is a controlling parameter in determining the forces and subtle variations in the phase can lead to large differences in the vortex dynamics and corresponding forces. Comparisons with laboratory data for large-scale flows reveals qualitatively similar behavior. We close by discussing prospects for using actuation to manipulate LEV formation and pinch off to control the forces.

Bio: Tim Colonius is Professor of Mechanical Engineering at the California Institute of Technology. He received his B.S. from the University of Michigan in 1987 and M.S and Ph.D. in Mechanical Engineering from Stanford University in 1988 and 1994, respectively. He joined Caltech in 1994, where he and his group use numerical simulations to study a range of problems in fluid mechanics, including aeroacoustics, flow control, instabilities, shock waves, and bubble dynamics. Prof. Colonius also investigates cavitation in medical applications of shock waves and ultrasound, and is a member of the Medical Engineering faculty at Caltech. He is a Fellow of the American Physical Society and has held visiting positions at Cambridge University and the University of Poitiers. He is Editor-in-Chief of the journal Theoretical and Computational Fluid Dynamics.

You are all kindly invited!