TEXAS TECH UNIVERSITY
Department of Mechanical Engineering
ME Seminar Spring 2015 Series

"The Nature of Vortex Breakdown"

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Abstract

Swirling flows play an important role in the environment (tornadoes) and technology (chemical, bio and nuclear reactors; delta-wing aircraft; vortex combustors). The core of a swirling flow can become bubble-like or helical, i.e. vortex breakdown (VB) occurs. The VB nature has been discussed more than a half-century, but no consensus has been achieved. It is argued that the VB nature can be explained with the help of the swirl decay and swirl acceleration mechanisms. The mechanisms clearly show why VB develop along and normal to the axis of rotation, how VB bubbles emerge, expand, become double and multiple. The mechanisms can potentially help in designing conventional and novel vortex devices. They also indicate possible means of the VB control.

Bio

Dr. Shtern is an applied mathematician. He graduated from Novosibirsk University, Russia (1963), received his Ph.D. (1970), Doctor of Sciences (1978), and Professor (1990) Degrees from the Institute of Thermal Physics (Novosibirsk, Russia). He worked at University of Houston, Texas (1990-2003), University of Seville, Spain (1993-1994), DLR Institute of Fluid Mechanics in Göttingen, Germany (1994-1995), University of Bristol, UK (1997), General Vortex Energy Inc. in Missouri City, Texas (2008-2010), and as a consultant at Ghent University, Belgium (2013-current). He also served as a consultant for Shell US and BP-Amoco Exploration companies. Dr. Shtern is a specialist in fluid mechanics and heat transfer with a focus on vortex flows, thermal convection, combustion, hydrodynamic instability, and bifurcation theory. His results include analytical solutions to the Navier-Stokes, Boussinesq, MHD, and compressible gas equations, and explaining mechanisms of intriguing and practically important flow effects, such as vortex breakdown, hysteretic transitions and multiple solutions, among others. Dr. Shtern is an author of three books, including *Counterflows* (Cambridge University Press 2012), and more than one-hundred papers. in Phys. Rev. Lett., Phys. Rev. E, Phys. Lett., Phys. of Fluids, J. Fluid Mech., Annu. Rev. Fluid Mech., Proc. Roy. Soc. Lond., AIAA, and other journals.

Monday, May 4, 2015
Livermore Center 101 | 2:00 – 3:00 pm
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