

Seminar on Continuum Mechanics
dedicated to the memory of
Professor Jindřich Nečas

6 December 2017, at 15:40

Faculty of Mathematics and Physics of the Charles University

Sokolovská 83, Praha 8, lecture hall K1

Program

15:40 Opening: Milan Pokorný, Charles University, Faculty of Mathematics
and Physics

15:45- 16:25 Giovanni P. Galdi

16:25- 16:40 coffee break

16:40 -17:15 Jiří Neustupa

Hopf Bifurcation in Navier-Stokes Flow
past a Rotating Obstacle

Giovanni P. Galdi

Department of Mechanical Engineering and Materials Science

Department of Mathematics

University of Pittsburgh, U.S.A

Abstract

We provide sufficient conditions for the existence of a time-periodic family of solutions branching out from steady-state solutions to the Navier-Stokes equations in the exterior of a body. The latter is allowed to translate with non-zero speed, and rotate with constant angular velocity $\omega_* \neq 0$. Our analysis shows, in particular, that, in addition to other technical assumptions, this type of bifurcation can occur if (and, in a sense, only if) the frequency of the resulting time-periodic flow, ω , and ω_* are commensurable with ω not an integer multiple of ω_* . In other words, $\omega = m\omega_*/n$ for some integers m, n with $m/n \neq \text{integer}$.

Stability of a Steady Navier-Stokes Flow
past a Rotating Obstacle

Jiří Neustupa

Institute of Mathematics

Czech Academy of Sciences, Prague

Abstract

We deal with a mathematical model of a Navier-Stokes flow past a rotating and possibly also translating body. We discuss the question of stability of a steady flow U (i.e. steady in a coordinate system attached to the body). Although the problem is considered in an exterior domain, we show that sufficient conditions for stability can be formulated in terms of an appropriate integrability on the time interval $(0, \infty)$ of a semigroup generated by an associated linear operator, applied to a finite family of suitable functions. We do not impose any condition of “smallness” of the steady flow U .

Organizers of the seminar:

Miloslav Feistauer

Jaroslav Haslinger

Martin Kružík

Šárka Nečasová