Joint Euromech / Eucass Colloquium 547: Trends in Open Shear Flow Instability Final Report

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Modern computational capabilities have spurred a very active development of new conceptual approaches and methods for hydrodynamic instability research in recent years. The colloquium succeeded in presenting a broad and rather complete overview of the state of the art, both from a physical and from a technical perspective.

58 researchers participated in the colloquium, among them 19 PhD students and post-docs. Indeed, a large proportion of the leading experts in the field was present. Participants came from institutions in eight different European countries (F, GB, E, I, CH, D, B, S), as well as one each from the USA and from Chile.

There were 38 oral presentations in total, spread out over the three days of the colloquium, and 12 posters were presented in a dedicated session. The keynote lecture was given by Patrick Huerre (LadHyX), and another special lecture by Peter Monkewitz (EPFL). Most sessions started with an introductory lecture of 40 minutes, given by the invited speakers: C. Caulfield (Cambridge), J.-M. Chomaz (LadHyX), T. Colonius (Caltech), N. Peake (Cambridge) and E. Wesfreid (ESPCI, Paris). All regular presentations were 20 minutes long, and organized in the following sessions:

- shear layers
- wall-bounded flows
- wakes
- jets
- geophysical and environmental flows
- complex flows
- aeroacoustics

The very large majority of all presented studies were of numerical and analytical nature. A few general trends can be observed: the computation of two- and even three-dimensional linear eigenmodes of non-parallel flows has become a commonplace tool for flow analysis. At the same time, the accessibility of these so-called "global modes" has not made the more traditional "local" instability analysis obsolete; many presenters have stressed the importance of local analysis, principally for physical interpretation of "global" results, but also for ease of application in industrial contexts. It is remarkable that transient growth and optimal initial perturbations, although immensely popular a few years ago, did not play an important role in the present colloquium. Instead, among the most recurring topics were a) nonlinear analysis, b) the study of the flow response to harmonic forcing, as well as c) the question how the effects of turbulence can be appropriately accounted for in a linear instability analysis.

A small number of contributions from this colloquium will be selected for publication in a special issue of the *European Journal of Mechanics B/Fluids*, which will be titled after the colloquium, and for which the colloquium organizers act as guest editors.

The echo from participants has been overwhelmingly positive. Even if the scientific program was very dense, social interaction took place during coffee breaks, a dinner banquet and a cocktail reception. Financial support was provided by Euromech, Eucass, E-CAero, École polytechnique and LaSIPS.