EUROMECH Final Report

EUROPEAN MECHANICS SOCIETY

Please send this report to the Secretary General of EUROMECH, within one month after the Colloquium.

EUROMECH Colloquium No: 423

Title: Boundary-Layer Transition in Aerodynamics

Dates and location: April 2-4, 2001, Stuttgart, Germany

Chairperson: S. Wagner

Co-Chairperson: M. Kloker, U. Rist

Is there need of another Colloquium on the same or a related subject? Which year? 2006

Full registration fee: DM 430,-

What other funding was obtained? Sponsoring by Deutsche Forschungsgemeinschaft, EADS Airbus, Universitaet Stuttgart, Flughafenstiftung Frankfurt/Main, AEA Technology, DaimlerChrysler, Porsche.

What were the participants offered? Stuttgart air, lunches, dinners, buffet dinner in international meeting center, beverages on table, coffee, cookies, inexpensive rooms at conference site

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Number of members of EUROMECH (reduced registration fee): 20

Number of non-members of EUROMECH (full registration fee): Non-menbers 48

Number of participants from each country:

Austria		Germany	28	Romania	
Belgium		Great Britain	8 (5)	Russia	12
Byelorussia		Greece		Slovakia	
Bosnia		Hungary		Slovenia	
Bulgaria		Ireland	(3)	Spain	
Croatia		Italy	2	Sweden	7
Czech Republic	2	Latvia		Switzerland	
Denmark		Lithuania		Ukraine	
Estonia		Netherlands		Yugoslavia	
Finland		Norway		Turkey	
France	4	Poland		Others (USA)	5
Georgia		Portugal		Total	68

Scientific Report

EUROMECH-Colloquium 423
„Boundary Layer Transition in Aerodynamics"
Universität Stuttgart, April 2 - 4, 2001
Chair: Siegfried Wagner; Co-Chair: Markus Kloker, Ulrich Rist

The conference site was the excellent Bildungszentrum Südwest of the German Telekom AG where the participants had also their rooms. Thus they could stay in closeness of the venue and meet and discuss also out of the official program. The symposium was attended by 68 scientists from 8 countries including the USA; 41 lectures were given, including 10 of participants of the German national cooperative research program (Verbund-Schwerpunktprogramm) „Transition". Due to the success of the "Transition"-EMC 359 held at the same place under similar conditions in 1997, 18 abstracts more than could be accepted were sent, and a selection had to be done. Since there were no parallel sessions and no posters, all contributions were treated equally within about 30 minutes each, except 5 keynote lectures of about 45 minutes. The organizers urged the chairmen from the very beginning to keep attention to sufficient discussion time after each lecture, and soon a lively, seminal scientific atmosphere arose that was appreciated with great pleasure (as a counterpart to the not rare speak-as-fast-and-short-as-possible-conferences).

The colloquium was divided into 9 sections taking into account the different stages and aspects of transition. The first subject was „receptivity", the filtering process bringing disturbances from the free stream into the boundary layer. The lecturers reported about theoretical as well as experimental results. Including William Saric´s (USA) keynote lecture 4 lectures were given. A main topic was how to clearly separate superposed sound and instability waves.

The next subject was transition in "two-dimensional boundary layers" with 9 lectures dealing mainly with late stages – formation/dynamics/breakdown of flow structures – and so-called by-pass mechanisms. The latter lead to turbulence without wave-like instabilities. These "streak instabilities" were reported in the keynote lecture of Henrik Alfredsson (S) and 3 other lectures.

The main session of the second day comprised 7 lectures and treated receptivity, linear and nonlinear instability and disturbance control in swept-wing boundary layers with crossflow. The presented material definitely showed that the secondary instability of saturated steady or unsteady crossflow vortices is of convective and not of absolute nature; also, the secondary mechanisms work equivalently for both steady and unsteady primary disturbances. The primary crossflow instability can be strongly influenced by a so-called three-dimensional upstream flow deformation by vortices with smaller spanwise spacing than the most unstable modes. Three other lectures on transition control concluded the sessions of the second day.

In the evening a buffet dinner took place at the university´s international meeting center "Eulenhof" where the scientists could discuss and talk purified by wine. Demonstrations like the video „A Nose Ahead" on flight experiments with boundary layer suction by G. Schrauf, EADS Airbus, were an informative and entertaining addition to the program.

The third day started with three lectures on industrial application aspects of transition prediction methods, with the keynote lecture given by Daniel Arnal (F). It turned out that still the exp(N)-method is routinely used despite its flaws for 3-d boundary layers; the physically more sound prediction based on the parabolized stability equations requires accurate initial disturbance amplitudes that cannot reliably provided yet. The "prediction" session was followed by three other lectures dealing with aspects of transition measuring techniques, also in supersonic flow.

Transition in super-and hypersonic flow was a main subject of EMC423. The survey by Anatoly Maslov (RU) was followed by 8 lectures. The necessity for and difficulties of "controlled" transition experiments were underlined, and a measurement method based on constant voltage hot-wire anemometer for high frequencies was presented. In a direct-numerical-simulation study it was found that for fundamental resonance associated with a primary acoustic disturbance the secondary mode has also to be of acoustic type if resonance is to set in effectively. Hermann Fasel (USA) finished the symposium with a lecture on a new methodology for flow simulations which is an alternative method to traditional Large-Eddy Simulations; it continuously switches, in dependency of local criteria, between a direct numerical simulation (DNS) and the solution of the Reynolds-averaged equations (RANS). The examples shown were encouraging.

The EMC423 was a very successful event. All participants enjoyed the warm but nevertheless not uncritical atmosphere. A third of the participants were Ph.D. students. Here we take again the opportunity to thank the national research council (DFG), the university of Stuttgart, EADS Airbus, airport foundation Frankfurt/Main, AEA Technology, EUROMECH, Daimler Chrysler and Porsche AG whose sponsorship allowed 10 Russian scientists to take part in the meeting. Besides, selected young scientists from all participating countries could be reimbursed for their conference fee.

Kloker/Rist/Wagner