IUTAM

Symposium Transsonicum IV

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Preface

"Symposium Transsonicum" was founded by Klaus Oswatitsch four decades ago when there was clearly a need for a systematic treatment of flow problems in the higher speed regime in aeronautics. The first conference in 1962 brought together scientists concerned with fundamental problems involving the sonic flow speed regime. Results of the conference provided an understanding of some basic transonic phenomena by proposing mathematical methods that allowed for the development of practical calculations. The "Transonic Controversy" (about shock-free flows) was still an open issue after this meeting.
In 1975 the second symposium was held, by then there was much understanding in how to avoid shocks in a steady plane flow to be designed, but still very little was known in unsteady phenomena due to a lack of elucidating experiments. A third meeting in 1988 reflected the availability of larger computers which allowed the numerical analysis of flows with shocks to a reasonable accuracy.

Because we are trying to keep Oswatitsch's heritage in science alive especially in Göttingen, we were asked by the aerospace research community to organize another symposium. Much had been achieved already in the knowledge, technology and applications in transonics, so IUTAM had to be convinced that a fourth meeting would not just be a reunion of old friends reminiscing some scientific past. The scientific committee greatly supported my efforts to invite scientists actively working in transonic problems which still pose substantial difficulties to aerospace and turbomachinery industry.

According to the aerospace community's understanding that some facets of aerodynamics and fluid mechanics involving transonic phenomena are still far from complete understanding as well as from a satisfactory practical handling, we focussed on six groups of contributions to shape the topics and sessions of the meeting program:

In the first group, work is devoted to inviscid steady and unsteady flow and toward their use in aeroelastic applications. With theories and models available from work reported in the past symposia, work remains to be done mainly for unsteady flow, even without the influence of flow viscosity. Local configurations of sonic locus, shock waves and flow boundaries have been subject to various mathematical approaches, work in this subject remains important also for passing the analytical knowledge base on to the younger generation of aerospace engineers.

The second group of contributions is devoted to viscous flows. Fluid flow with viscosity adds phenomena which prohibit analytical treatment in many cases.

Viscous-inviscid flow interaction in aerospace and in turbomachinery applications need a refined treatment of local interactions between shocks and boundary layers. A report about the European Transonic Windtunnel is presented as a mature experimental test facility for the aircraft industry to model realistic flight Reynolds numbers.

With tremendous success in Computational Fluid Mechanics, this meeting was not intended to report about the status of Computational Fluid Dynamics (CFD). In the third group only a few innovative contributions follow a comprehensive review about the development of transonic CFD through the past four decades. Design rather than analysis seems to be a task requiring a systematic use of the transonic knowledge base. Reporting the status of practical design optimization in the industry is complemented by outlining novel strategies to arrive at optimization with affordable computer time.

Applying optimization to the hardware of aircraft wings and helicopter rotors results in the development of flow control techniques which partly are brought to reality by an adaptation of shape components through mechanical devices: Progress in this field is reported by a fourth group of contributions.

Renewed interest in supersonic civil transport (SST) resulted in a few research projects during the past decade. Inevitably an SST will have to pass the sonic flow regime which is still seen as an issue for both economical operation as well as for ecological problems stemming from the sonic boom. These problems are of a transonic nature, recent progress is being reported in the fifth group.

Finally, in a small sixth group we present some results for real gas effects like dissociation and condensation. These will be useful for introduction into the operational methods dealing with ideal gas models.

65 scientists from 13 countries in Europe, Asia and America have been participants at this symposium. There are 55 articles presented in this proceedings publication.

During the meeting, we have provided several social events to allow contacts and discussions between the scientists during the 5 days of the meeting. The city of Göttingen offered sightseeing and unlike during the previous symposia we had the privilege for a first time to have an excursion across the former iron curtain to the province of Thüringen. This reminded us about Klaus Oswatitsch who in 1962 thought how unfortunate it was that no participants from the Eastern European countries were able to attend the first Symposium. So besides the value of compiling the status of transonics in 2002, we are happy that now we have a free ex-

change of ideas, opinions and results from the scientific community.

The symposium was organized and hosted by DLR Göttingen. Conference secretary Elisabeth Winkels was in charge for arranging the meeting and the organisation for the social events. Monika Hannemann organized the technical support for the presentations and provided an internet presence of this meeting before and after the event. Dagmar Brennecke helped with registration and foreign languages during the meeting.

The scientific committee has contributed greatly to the success of the meeting by proposing already highly recognized as well as promising young scientists and reviewing their work. Special thanks goes to Alfred Kluwick who helped to convince IUTAM at the 2000 ICTAM congress when funding of this symposium had to be decided. The organizers of this Symposium are very grateful to IUTAM for the financial support.

Göttingen, December 2002 Helmut Sobieczky, Editor