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Symposium Transsonicum IV

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Contents

Preface	xiii
----------------	------

1. Inviscid flow models

Steady flows

Zierep, J. New Results for the Normal Shock in Inviscid Flow at a Curved Surface	1
--	----------

Hunter, J.K., Tesdall, A.M. Transonic Solutions for the Mach Reflection of Weak Shocks	7
--	----------

Kuz'min, A.G. Interaction of a Shock Wave with the Sonic Line	13
---	-----------

Liu, D.D., Mignolet, M. Transonic Wedge / Cone Flow Solutions Using Perturbed Potential and Euler	19
---	-----------

Prasad, P. Upstream Propagating Curved Shock in a Steady Transonic Flow	25
---	-----------

Hafez, M. Non-Uniqueness in Transonic Flows	33
---	-----------

Unsteady flows

Caughey, D.A. Unsteady Transonic Flow past „Non-unique“ Airfoils	41
--	-----------

Bur, R., Berthouze, P. Forced Oscillation of a Shock-Wave in a Transonic Channel Flow	47
---	-----------

Tang, L., Liu, D.D., Chen, P.C. Nonlinear Aerodynamic Effects on Transonic LCO Amplitude of a Supercritical Airfoil	53
---	-----------

Schwamborn, D., Weinman, K. 59
On the Influence of Turbulence Modelling on Steady and Unsteady Flows

Aeroelastics

Ballmann, J., Boucke, J., Braun, C. 65
Aeroelastic Sensitivity in the Transonic Regime

Castro, B. M., Jones, K. D., Platzer, M. F., Weber, S., Ekaterinaris, J. A. 71
Numerical Investigation of Transonic Flutter and Modeling of Wind Tunnel Interference Effects

Chen, P.C., Liu, D.D. 79
Efficient Transonic Method for Aeroelastic Applications Including Aircraft/Stores

Liu, G.-L. 85
A Unified Variational Formulation of Aeroelasticity Problem for Coupled 'Fluid-Wing' Vibration System in 3-D Unsteady Transonic Flow

2. Viscous flows

Viscous-inviscid interaction

Delery, J.M. 91
The Different Facets of an Old but Always Present Concern: Shock-Wave/Boundary Layer Interaction

Jones, K.D., Platzer, M.F., Rodriguez, D.L., Guruswamy, G. 99
On the Effect of Area Ruling on Transonic abrupt Wing Stall

Kluwick, A., Braun, S., Gittler, P. 105
Transonic, Laminar High Reynolds Number Flow in Slender Channels

Ruban, A.I., Türkyilmaz, I., Buldakov, E.V. Viscous-Inviscid Interaction and Boundary-Layer Separation in Transonic Flows	111
Ryzhov, O.S., Bogdanova-Ryzhova, E.V. Boundary Layer Instabilities in Transonic Range of Velocities	117
Zierep, J., Bohning, R., Doerffer, P. Perforated Plate Aerodynamics for Passive Shock Control	125
 <i>Internal flows</i>	
Dvorak, R. Internal Transonic Flows	131
Safarik, P., Luxa, M. Transonic Flow past Plane Cascades: Experimental Data Analysis	139
Dobes, J., Fürst, J., Fort, J., Halama, J., Kozel, K. Numerical Simulation of Transonic Flow in Steam Turbine Casca- des - the Role of Numerical Viscosity, Grid Type and Approxima- tion of Boundary Conditions	145
Gerolymos, G.A., Vallet, I. Reynolds-Stress Modelling for Transonic Shock-Wave/Boundary- Layer Interaction	151
 <i>Experimental techniques</i>	
Hefer, G. ETW - A Facility for High Reynolds Number Testing	157
Rosemann, H., Richter, K. Gurney Flaps in Transonic Flows	165
Meier, G. E. A., Stasicki, B. Density Measurement of Large Scale Transonic Flow Fields	171
Rein, M., Erdi-Betchi, A., Klinkov, K.V. Transonic Flow Phenomena of the Cold Spray Deposition Process	177

3. Numerical methods

CFD new analysis approaches

Caughey, D.A., Jameson, A. 183
Development of Computational Techniques for Transonic Flows:
An Historical Perspective

Hirose, N. 195
Transonic Aerodynamics Research Retro- and Prospective in Japan

Bramkamp, F., Ballmann, J. 201
Implicit Euler Computations on Adaptive Meshes for Steady and
Unsteady Transonic Flows

Eberle, A. 207
Efficient and Refined Transonic Flow Analysis Using a New Flux
Vector Splitting Scheme

Fort, J., Fürst, J., Jirasek, A., Kladrubsky, M., Kozel, K. 211
Numerical Solution of 2D and 3D Transonic Flows over an Airfoil
and Wing

Hafez, M. 217
Alternative Formulations for Transonic Flow Simulations

Rachwalski, J., Magagnato, F., Gabi, M. 225
The Buffer Layer Technique Applied to Transonic Flow Calculati-
ons

Design and Optimization tools

Li, P., Om, D. 231
Design Applications in the Industry

Daumas, L., Dinh, Q.V., Kleinveld, S., Roge, G. 239
How to Take in Account Deformation in a CAD-Based Euler Opti-
mization Process?

Holst, T.L., Pulliam, T.H. 245
Transonic Wing Shape Optimization Using a Genetic Algorithm

Jameson, A. Optimum Transonic Wing Design Using Control Theory	253
Lutz, T., Sommerer, A., Wagner, S. Parallel Numerical Optimisation of Adaptive Transonic Airfoils	265
Zhu, Z. Computation of Biobjective/Bidisciplinary Optimization	271

4. Flow control and adaptive configurations

Flow control

Fulker, J.L. A Review of Research at QinetiQ on the Control of Shock Waves	277
Smith, A.N., Babinsky, H., Fulker, J.L., Ashill, P.R. Experimental Investigation of Transonic Airfoil Shock / Boundary Layer Interaction Control Using Streamwise Slots	285
Tulita, C., Raghunathan, S., Benard, E. Control of Transonic Periodic Flow on NACA 0012 Aerofoil by Contour Bumps	291
Corre, C., Renaud, T., Lerat, A. Transonic Flow Control Using a Navier-Stokes Solver and a Multi-Objective Genetic Algorithm	297

Adaptive Configurations

Geißler, W., Koch, S. Adaptive Airfoil	303
Trenker, M., Hannemann, M., Sobieczky, H. Surface Parameterization for Configuration Adaptation	311

5. Supersonic flows

Supersonic Transport Design Aerodynamics

Matsushima, K., Yamasaki, W., Nakahashi, K. 317
Transonic Design of SST - To Employ Japanese SST as a Candidate
for Near Sonic Transport

Sobieczky, H., Li, P., Seebass, R. 325
Transonic Methods for Oblique Flying Wing SST

Sonic Boom: Analysis and Optimization

Cheng, H.K., Hafez, M.M. 331
The Superboom as a Tricomi Problem: Extensions and Applications

Coulouvrat, F., Marchiano, R., Thomas, J.-L. 339
Numerical and Experimental Simulation of Sonic Boom Focusing

Argrow, B., Farhat, C., Maute, K., Nikbay, M. 345
Linear-Theory-Based Shape Optimization for Sonic Boom Minimi-
zation

Nadarajah, S.K., Kim, S., Jameson, A., Alonso, J.J. 351
Sonic Boom Reduction Using an Adjoint Method for Supersonic
Transport Wing-Body Configurations

6. Real gas effects

Multiphase flow

Put, A., Kelleners, P.H., Hoeijmakers, H.W.M. 359
Development of a Numerical Method for Simulating Transonic Mul-
tiphase Flows

Schnerr, G.H., Goodheart, K. 365
Unsteady Nonadiabatic Transonic Two-Phase Flow

Dissociation

Hornung, H.G., Leyva, I.A. 377
The Sonic Line and Shock Detachment in Hypervelocity Cone Flow

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 organization 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