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MEGAFLOW - Numerical Flow Simulation for Aircraft Design

Results of the second phase of the German CFD initiative MEGAFLOW, presented during its closing symposium at DLR, Braunschweig, Germany, December 10 and 11, 2002

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ISSN 1612-2909
ISBN 3-540-24383-6 Springer Berlin Heidelberg NewYork
ISBN 978-3-540-24383-0 Springer Berlin Heidelberg New York

Library of Congress Control Number: 2004117724

Springer is a part of Springer Science+Business Media
springeronline.com

Printed in Germany

Typesetting: Digital data supplied by editors
Cover design: deblik Berlin
Printed on acid free paper 89/3141/M - 5 4 3 2 1 0

Preface

The aerospace industry is increasingly relying on advanced numerical simulation tools in the early aircraft design phase. Today, under the pressure of economic and ecological requirements, not a single new aircraft development can be done without the intensive support of computational fluid dynamics (CFD). Nevertheless, there is still a great need for improvement of numerical methods, as standards for simulation accuracy and efficiency are constantly rising in industrial applications. Moreover, it is crucial to reduce the response time for complex simulations, although the complexity of relevant geometries and underlying physical flow models are constantly increasing.

In order to meet the requirements of German aircraft industry, the national project MEGAFLOW was initiated some years ago under the leadership of DLR. The main goal was to focus and direct development activities carried out in industry, DLR and universities towards industrial needs. The close collaboration between the partners led to the development and validation of a common aerodynamic simulation system providing both a structured and an unstructured prediction capability for complex applications. The software is constantly updated to meet industrial requirements.

In the first phase of the project (1996-1998) the main emphasis was on the improvement and enhancement of the block-structured grid generator MegaCads and the Navier-Stokes solver FLOWer. In the second phase (1999-2002) activities were focused on the development of the unstructured/hybrid Navier-Stokes solver TAU. Due to a comprehensive and cooperative validation effort and quality controlled software development processes, both flow solvers have reached a high level of maturity and reliability. The MEGAFLOW software is used in the German aeronautic industry and in research organizations for a wide range of applications. At universities the software is used for improvements of physical modeling and investigations of specific flow problems. Due to the use of a common software base, the process of transferring latest research and technology results into production codes has been considerably accelerated.

This volume entitled "MEGAFLOW — Numerical Flow Simulation for Aircraft Design" contains results presented during the closing symposium of the project which took place at DLR in Braunschweig, Germany, on December 10th and 11th 2002. Contributions are from DLR, aircraft industry and several universities. The selected papers focus on the activities of the second phase of the project. They give a good overview of the algorithmic features and physical modeling capabilities of the MEGAFLOW software. The prediction capabilities of the software are demonstrated by several validation test cases and large scale applications for aircraft design.

During the course of the MEGAFLOW project an efficient and open minded German network with partners from universities, research organizations, the aircraft industry and small enterprises has been created. This network has proved of great value for the establishment of numerical simulation as a well recognized and essential tool in the aircraft design process. Based on this network the numerical capabilities for aerodynamic shape design and multidisciplinary optimization will be further developed and improved within the follow-on project MEGADESIGN (2003-2007).

Thanks are due to all partners who have contributed in the context of the MEGAFLOW project in an open and collaborative manner. The knowledge and engagement of each individual contributed to the success and world wide appreciation of the MEGAFLOW project and software.

Furthermore, the funding of partial activities through the German Government in the framework of the air transport research program is gratefully acknowledged.

The editors are grateful to Prof. Dr. E. H. Hirschel as the general editor of the Springer series "Notes on Numerical Fluid Mechanics and Multidisciplinary Design" and also the staff of the Springer Verlag for the opportunity to publish the technical results of the MEGAFLOW project in this series.

Braunschweig,
Oktober 2004

Norbert Kroll
Jens K. Fassbender

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