Aerodynamics of Bladed Machinery
(Aerodinamica masinilor cu palete)

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This text provides to the specialists in the field of turbomachinery a set of mathematical models for the analysis of aero- and gas dynamic processes, which occur during the operation of bladed machines.

The paper was printed by the publisher "Editura Academiei Romane", Bucharest, Romania, 2010, and contains 915 pages grouped in 13 chapters.

Although the processes in the turbomachinery are highly complex, the authors of this paper have focused their attention mainly on the aerodynamic phenomena underlying the operation of this kind of machines.

The present paper was designed in two main parts (although they do not appear explicitly as such): Chapters 1-7 are focused on the fundamentals of *Thermodynamics*, *Aerodynamics* and *Gas Dynamics*, while the chapters 8-13 are referring to the blade cascades and their applications.

Also, for a better understanding, the authors have tried to present the problems in a gradual way, from simple to complex.

Thus, after an overview of the main types of bladed machines, the early chapters of the paper depict the main results of the *Thermodynamics* of ideal and real gases, offering formulas which will be applied later, in the subsequent chapters, in order to estimate the performances of the machines.

The basic equations of *Gas Dynamics* written in a very general form are detailed in the next, together with all the theorems necessary for the analysis of flow through the blade cascades.

Although the presented equations can be successfully used for numerical approaches, the paper does not insist on this point. Instead, there are developed some simplified models, which yield analytical solutions very useful for the pre-design process.

A separate chapter is devoted to the compressible flow, highlighting the basic equations of flow in subsonic, transonic and supersonic regime, along with some original developments proposed by the authors, leading to useful results for the analysis of flow through blade cascades.

The viscous flow is treated separately by using various boundary layer models for laminar, turbulent, incompressible and compressible regimes.

The *Aerodynamics* of airfoils and the methods of analysis of flow around them are presented in a special section. Since the results are applied later to the blade cascades, some practical applications with numerical outputs are included.

The airfoil cascades are treated in the subsequent chapters, where several methods of analysis are presented and concrete numerical applications are performed as comparison between various methods.

There are treated sequentially: linear cascades, circular cascades (both in the incompressible regime) and linear cascades in compressible flow. Numerical results are presented as examples of application for the theoretical methods previously shown.

A subsequent chapter is dedicated to the presentation of three-dimensional models of flow through the blade cascades. Here, an original model of analysis leading to more precise results is detailed (method of secondary flows).

The next chapter is focused on solving the direct problem of blade cascades approached as a useful tool for the design engineers dealing with the estimation of compressors and turbines maps. Also, the problem of instability that may occur in the bladed machines is analyzed in the later chapter.

A final section is dedicated to the air propellers and wind turbines, describing the aerodynamic methods of analysis, which are similar to those used for the blade cascades.

The bladed machines have various applications. Many of them are the basis of the aviation propulsion systems, so that some notations used in this paper come from the aircraft literature. However, the general equations describing the aerodynamic phenomena are the same, regardless of the end use of the bladed machines.

The References contain 118 titles, 17 of them being original contributions of the authors.

As a conclusion, the book can be considered to be of great use to all those who are in contact with the bladed machines, but it is primarily intended for designers and researchers in the field.

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