

## BOOK REVIEWS

E. BLUMS, YU. A. MIKHAILOV and R. OZOLS, **Heat and Mass Transfer in MHD Flows**. World Scientific, distributed by Wiley, 1987, £42.60.

THE THEORY of MHD flows has existed as a scientific discipline for a number of decades but still it remains a rather esoteric area in the perception of most researchers dealing with fluid mechanics. One of the reasons for this situation is that only a very few books on MHD flows have been published in the English language. Those books which do exist, beginning with the excellent works of J. A. Shercliff, deal almost exclusively with theory and therefore many students have the feeling that MHD is a rather abstract exercise dealing with remote phenomena distant from any tangible reality.

In view of the above, appearance of books like the one discussed here is highly desirable. Blums *et al.*'s book presents a broad overview of the up-to-date status in a specialized area within MHD, namely, heat and mass transfer in MHD flows. The book introduces the Western reader to the vast amount of results, mainly experimental, achieved in different institutions in the Soviet Union and until now published only in Russian. The greatest part of the book is based on the results obtained by the book's main contributor, E. Blums. During two decades, he conducted pioneering experimental work at the Latvian Academy of Science in Riga. He started with heat and mass transfer in electrolytes exposed to an external magnetic field; then went on to other electroconductive liquids and finally included in the scope of his work magnetizable fluids.

The book consists of eight chapters, the first of which presents general principles of non-equilibrium, thermodynamics and equations for heat and mass transfer in conducting and non-conducting media. From Chapter 2 on, the book deals with specific MHD flows and transfer phenomena in detail. Chapter 2 is dedicated to heat transfer in laminar MHD flows. It begins with theoretical solutions for typical cases of laminar MHD flow and analysis of fundamental phenomena in such flows and continues with an analysis of heat transfer in one- and two-dimensional laminar MHD flows. Here results of several experimental studies are presented along with theory. In the rest of the book, the material presented becomes gradually more and more experimental and these are the chapters which we believe will be most interesting and valuable to the reader.

Chapter 3 treats free MHD convection problems while Chapter 4 is dedicated to convective mass transfer in magnetic fields. In Chapter 4 the authors discuss not only general features of mass transfer in electroconductive media but present more specifically experimental results related to mass transfer in electrolytes, mass transfer under conditions with diffusion and chemical reactions and finally phenomena in an MHD boundary layer on a permeable surface.

Chapter 5 deals with heat and mass transfer in magnetizable fluids. The range of phenomena discussed here is actually beyond the scope of phenomena normally regarded as magnetohydrodynamics. Magnetizable fluids or ferrofluids manifest a number of fascinating features going beyond anything which could be imagined in the framework of conventional fluid mechanics. The problems of drop shape in magnetic field, surface instabilities, levitation and buoyancy of solid bodies are all of great interest. In this chapter

the reader is also introduced to most unusual phenomena of thermomagnetic convection and diffusion in magnetizable fluids.

Chapter 6 goes back to a more traditional subject, namely turbulent heat and mass transfer in electroconductive fluids exposed to a magnetic field. Here, the most interesting and practically important phenomena is the strongly anisotropic or two-dimensional turbulence with very unusual transfer phenomena.

Chapters 7 and 8 present practical applications and methodology of heat and mass transfer in magnetic fields for both electroconductive and magnetizable fluids. These two chapters will probably be the most valuable for readers specializing in applied MHD as well as for those not in the field but willing to understand what MHD is, and what is its promise from the practical point of view. The applications chapter is very impressive. It treats applications in the field of energy conversion, chemical engineering, metallurgy devices using phenomena of thermomagnetic convection, magnetic filters and probably the most exciting applications in biology and medicine—magnetic occlusion of arterial aneurysms and magnetophoresis in biological suspensions.

The concluding chapter presents the adjustment of conventional measuring methods, for example, application of thermoanemometry to the unusual conditions of MHD as well as some very special methodologies using electrochemical phenomena and unique approaches for studying magnetic colloids and suspensions.

Unfortunately, the book is not completely free of shortcomings. The presentation is, in most parts of the book, too descriptive. It does not provide the reader with tools and detailed information necessary for practically treating specific problems which are discussed. It probably would be more advantageous for the reader if the authors instead of covering a vast number of flow cases and phenomena, would select a more limited number of cases and provide more detailed information, methods of computation and all of the tools necessary for solving practical problems. Another unfortunate drawback is that the book is almost completely lacking references on works done in Western countries and published in the English language literature. Thus, for instance, in Chapter 6, dedicated to turbulent MHD flows there are only a very few references to publications in Western countries and even those relate to works done back in the 1960s or early 1970s. Nothing is said about very important results on two-dimensional turbulence which were obtained at the end of the 1970s and later in several MHD study centres in the West.

Finally, there is an impression that the English of the book did not undergo enough literary editing and this detracts substantially from the value of this interesting and important book.

Despite the minor deficiencies mentioned above, this book will be valuable for researchers, practical engineers and students who already work in MHD. It will also doubtless attract to this fascinating area many individuals for whom this book will be the first inspiring encounter with MHD.

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