Preface

It is 39 years since sea trials of the first hovercraft. Hovercraft are a new means of transportation, and so machinery, equipment and structural materials have had to be adapted for successful use in their special operating environment, which differs from that in aviation and for other marine vessels.

A somewhat difficult technical and economic path has been negotiated by the developers of hovercraft technology to date. Currently about 2000 craft are in operation for commercial water transportation, recreation, utility purposes and military applications around the world. They have taken a key role for a number of military missions, and provide utility transportation in a number of applications which are quite unique.

Hovercraft in China have developed from prototype tests in the 1960s, to practical use as ferries and military craft. More than 60 hovercraft types have been constructed or imported for operation in China. This book has been written to summarize the experience in air cushion technology in China and abroad to date, with the aim of improving understanding of air cushion technology.

Due to the relatively quick development of the cushion technology relative to other water transportation, the theories and design methods applied to hovercraft design and operations are continuing to develop at present. For instance various quasi-static theories of the air jet cushion were derived in the 1960s, but once the flexible skirt was developed, the hydrodynamic and aerodynamic forces acting on hovercraft changed so significantly that these earlier theories and formulae could not continue to serve in practice.

The theory of air cushion performance has therefore changed significantly since the 1960s. On one hand a lot of technical references and some technical summaries and handbooks with respect to air cushion technology are available to translate the physical phenomena but on the other, owing to different research methods, objects and means, there are many different methods which suggest how to deal with such theories. So far no finalized rules and regulations for hovercraft construction can be stated. In addition regulatory documents concerned with stability, seaworthiness and the calculation methods determining the static and dynamic deformation have not reached public literature.

The aim in writing this book has been to summarize the technical experience, both in China and abroad, to systematically describe the theory and design of hovercraft, and endeavour to connect the theories with practice in order to solve practical problems in hovercraft design.

There are three parts to this book. The first chapter gives a general introduction to hovercraft, which introduces briefly the classification of hovercraft, and the development and civil and military applications of the hovercraft in China and abroad in the last three decades. The second part, from Chapters 2 to 9, systematically describes ACV and SES theory – primarily the hydrodynamics and aerodynamics of cushion systems. The third part, from Chapters 11 to 16, describes the design methods of ACV and SES, including the design criteria and standards for craft performance, lift system design, skirt design, hull structure design, and methods for determining the principal dimensions of craft.

The principles for material presented in this book are to describe the features of air cushion technology, and give sufficient design information to allow the reader to prepare a basic project design. Engineering subjects which are similar to those for conventional ships are not covered here, being available to the student in existing naval architecture or marine engineering texts. Thus, stability here covers only the calculation method for stability of ACV and SES on cushion, and not stability of hovercraft while floating off cushion.

With respect to the design of machinery and propulsion systems of ACV and SES, for instance, air or water propeller design, water-jet propulsion installation and machinery installtion in hovercraft, which is rather different from that on conventional ships, these are covered in summary in the last chapters.

The intent is to guide the reader on how to perform machinery and systems selection within ACV or SES overall design. Detail design of these systems requires support of specialists in turbo-machinery, piping design, etc. who will normally be included in the project team. The student is referred to specialists in these fields for interface engineering advice, or to the marine or aeronautical engineering department at his college or university.

The intended audience for this book are teachers and students, both at undergraduate and postgraduate level in universities, and engineers, technicians and operators who are involved in ACV/SES research, design, construction and operation or wish to work in this field.

During the writing of this book, the authors have had the help and support from senior engineers and researchers of MARIC and used research results and theories from many sources, such as the references listed at the end of this book, and they would like to express sincere thanks to those authors for their inspiration. Meanwhile the authors also would like heartily to thank Professor J.S. Dong of the Chinese Naval Engineering Academy for his help and revision suggestions for this book.

Hovercraft and component manufacturers throughout the world have kindly supplied data and many of the photos. Our thanks for their continuing support and advice.

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