

Foreword of the Editor

The present book *Cavitation of Hydraulic Machinery* is a volume in the Hydraulic Machinery book series. It covers cavitation related subjects from fundamental mechanisms to practical applications in turbines and pumps¹.

Cavitation is one of the most unwanted phenomena in hydraulic machinery despite the fact that it does have some positive effects in other fields. Although a great advance in understanding this phenomenon has been achieved in the last 100 years, our knowledge about cavitation is not good enough to precisely predict and completely solve this problem. Nowadays, most of the cavitation related work in hydraulic machinery still, to a great extent, relies on previous experience, model test and prototype observation.

After introducing cavitation and its relationship to hydraulic machines, the rest of this book falls naturally into two parts. The first part, Chapters 2, 3 and 4, deals with the fundamental knowledge necessary for understanding the cavitation involved in hydraulic machines. It includes: cavitation types, scale effects, nucleation and inception, single bubble dynamics, multi-bubble dynamics (bubble-bubble, bubble-boundary and bubble-flow interactions), stochastic models of cavitation bubbles, noise spectra, cavitating flows of hydro-foil and cascade, cavitating characteristics of valves and other hydraulic elements. The second part, Chapters 5, 6, 7 and 8, deals with cavitation related themes in turbines and pumps such as cavitation features, similarities, cavitation detection techniques, cavitation damage mechanism and features, synergism of cavitation with silt erosion, material resistances to cavitation damage, cavitation-damage repair, cavitation-induced pressure-pulsations, cavitation resonance, cavitating transient flow and computer simulation. As it is impossible to include all relevant subjects in a single volume, careful selection has been necessary. Only those basic concepts and new developments which are not covered by existing books and review articles² are given in-depth treatment. Extensive lists of references and footnotes are thus included to support the presentation and assist readers who want to dig deeper.

A total of 17 authors from 7 countries, all experts in their chosen fields, have made contributions to the book. By drawing upon wide resources and

¹As agreed at the Inaugural Meeting of the International Editorial Committee, the Book Series would deal only with hydro-turbines and pumps.

²Such as *Cavitation* by Knapp/Daily/Hammit (1970), *Cavitation* by Young (1989), *Cavitation and Bubble Dynamics* by Brennen (1995) and 'Cavitation in Fluid Machinery and Hydraulic Structure' (*Ann. Rev. Fluid Mech*) by Arndt (1981) etc.

experiences from North America, Europe, China, Russia, Japan etc, the book aims to give a more balanced view of the various topics. The editor is greatly indebted to all the authors for their valuable contributions and effective cooperation over last 12 years. Without their great efforts, the book would not have been possible. In particular, I would like to say a few words in memory of Professor Pierre Henry who died on 26th April 1994 from cancer. We miss him very much, he was only 54 and had built up the Lausanne Laboratory and established a brilliant reputation in unsteady operating conditions due to cavitating vortices. The sections of §7.1.3, §7.3 and §7.4 he wrote were mainly based on that remarkable work.

The structure and content of this book was originally proposed by the editor in 1983 as a monograph to be written in collaboration with Professor Fredrick G. Hammitt (University of Michigan, USA) as an effort to bridge the existing gap between fundamental cavitation phenomena and cavitation-related subjects in hydraulic machines. This book, together with another proposed joint book on the topic of transients in hydraulic machines, subsequently provided the inspiration for the Hydraulic Machinery book series. The International Editorial Committee (IECBSHM) was established for this purpose in 1986 in Beijing. Unfortunately, a deterioration in his health denied Professor Hammitt the opportunity to participate in the book. Nevertheless, his enthusiastic response to the editor's initial motion was a vital support and encouragement. I would like to take this opportunity to say a special word of thanks in memory of Fred, who passed away in 1989.

In order to provide up-to-date information to our readers, authors were allowed to amend their contributions right up to the last minute, squeezing the editing and compilation into the last few months. This presented me with a very complicated and intensive job. The support of the following persons was invaluable in achieving this. Many experts were invited to review manuscripts. Their constructive criticism, comments, discussion and suggestions are highly valued by the authors and the editor. They are Professor Peter W Carpenter (Warwick University, UK), Professors Allan Acosta, Dr. M L Billet and Professor C E Brennen (California Institute of Technology, USA), Dr. R K Turton (Loughborough University, UK) and Mr. Harland Topham (Water Turbine and Pump Consultant, UK). Thanks also go to Professor Duan C G and Dr A P Boldy of IECBSHM for their support; to Professor H Murai for his assistance in coordinating with some authors in the early stage; to Dr. Tony Price and Dr. Wanda Lewis (Warwick University, UK) for their advice; to Mrs. Wendy Murray (IT Services, Warwick University) for her assistance in preparing computer-editable source files from some

manuscripts; and to Mr. Alan Hulme (the Engineering Computer Manager) and the secretaries for their effective support.

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During the publishing process, the advice received from the commissioning editors, Dr John Navas, Mr Anthony Doyle, and the desk editor, Mr Yeow Hwa Quek, was vital that made this volume eventually available to our readers.

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The figures in the book have come from a variety of sources. The acknowledgement appears in the caption as a parenthetical reference keyed by the name(s) of the original author(s) and a number to the list of references at the chapter end where the source is cited in full. A particular thank you goes to Mr. R Stahel (Sulzer Hydro Ltd, Switzerland) who kindly supplied me with the original photos of Figures 6.14, 6.23, 6.24, 6.26 and 6.27.

Finally, the editor is in great debt to his family members for their understanding, support and forbearance during the lengthy process of writing and editing this book.

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