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book reviews

Cavitation and Related Phenomena in Lubrication, Edited by D. Dowson, M. Godet, and C. M. Taylor, Mechanical Engineering Publications, Penthouse 1, 15 West 55th Street, New York, New York, 10019, 248 pages, $48.00, 1975.

Reviewed by Donald F. Hays[1]

This volume contains the Proceedings of the First Leeds-Lyon Symposium which was held in Leeds, England in September 1974. It includes the 27 papers (and the discussions) which were presented on the subject of, "Cavitation and Related Phenomena in Lubrication."

The volume provides an opportunity for an extensive look at the phenomena of flow separation and cavitation in lubricating films. Among the problems considered are those of the liquid-gas interface in two phase flow, the behavior of bubbles in thin films of viscous liquids and the effects of collapsing vapor filled bubbles in fluid films. These problems are not to be treated lightly, but require considerable zeal and dedication on the part of analysts and experimentalists if the physics of the flow are to be understood.

The Symposium has taken a modern look at this subject that has perplexed, bothered and intrigued fluid film analysts since the time of Reynolds classical work. Over the past 90 years, there has been much speculation regarding the conditions under which fluid separation and cavitation occur and a number of simplified assumptions have been made to expedite the numerical solutions to fluid film problems. This volume brings out the most recent views on these conditions and the results obtained when applying the assumptions to the basic equations which define the characteristics of fluid film bearings. One finds that today there are no unified, universally accepted conditions for this separation phenomenon.

Three important aspects of cavitation and flow separation are treated: (1) the physical conditions which exist in the fluid film and on the film boundary during flow separation and cavitation, (2) the manifestations of these phenomena on the characteristics of bearings, and (3) the consequences of cavitation in terms of bearing material damage. These subjects are addressed in 27 papers; the number of papers in each category being as follows: Fundamentals-3; Film Rupture Conditions-7; Cavitation in Dynamically Loaded Bearings-5; Cavitation in Synovial Joints-1; Starved Lubrication and the Inlet Boundary-5; Cavitation Damage-3; Cavitation in Seals-2; Research Report and Final Discussion-1.

Although both theoretical and experimental work are discussed in this volume, much of the reported work is academic or research oriented in nature. This basic research approach to cavitation and separation is reflected by the authors of the papers: 29 are from universities and 7 from industrial units and these being research oriented centers. It is felt that this volume will be of greatest interest to those persons who are in a research area and will be of particular interest to analysts who are concerned with the appropriate boundary conditions which should be applied to the partial differential equations which characterize bearing performance.

Some very practical and important consequences of fluid film cavitation have also been addressed in this Symposium. There are excellent illustrations and discussions of cavitation damage in plain bearings of gasoline and diesel engines. As was pointed out, cavitation can lead to a gross metal removal from bearing surfaces, or it may alter the chemical films on these surfaces and provide opportunities for corrosion to occur. Good, clear photographs of cavitation damage in bearings is presented.

The type is clear, diagrams are bold and readable and the photographs are excellent in revealing cavities that have formed in films or damage to bearing surfaces. Although this is a relatively large volume, being approximately $8\frac{1}{4} \times 11\frac{3}{4}''$, and covering 248 pages, the price of $48.00 may prevent the book from appearing on the bookshelf of many individuals. However, it should be available for ready reference in the libraries that serve those who have interests in this field. It is certainly an excellent reference volume on the current state-of-the-art in flow separation, cavitation, and related phenomena in lubrication.

[1] Assistant Department Head, Engineering Mechanics Dept., Research Laboratories, GM Technical Center, Warren, Mich.