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CAVITATION IN HYDRAULIC MACHINERY AND STRUCTURES

Essential Thesis

The aim of the contribution is to deliver a brief survey of existing knowledge and experience in the field of cavitation. The presentation will be divided into three sections: 1. physical background, 2. cavitation effects in hydraulic equipment and biology, 3. current research topics. Selected problems in each of these areas will be discussed.

In section 1 cavitation will be defined as a non-equilibrium phase transfer process. Cavitation inception under static, steady-flow and transient conditions will be discussed. Various forms of incipient and developed cavitation will be indicated, including bubble, sheet and vortex cavitation, cavitation clouds and supercavities. Mechanics of cavitation impingement resulting out of a collapse of cavitation bubbles and vortices will be presented.

In section 2 some typical cavitation effects, including deterioration of performance characteristics, vibro-acoustic effects and damage to the structural material will be discussed. Hydraulic turbines, pumps, valves, ship propellers, bearings, civil engineering structures and will be listed as some typical places of cavitation occurrence. Attention will be driven to unsteady phenomena in hydraulic systems. Some cavitation effects in living organisms (cracking of joints, decompression sickness etc.) will be also indicated. Application of cavitation for industrial purposes (cleaning of surfaces, washing, underwater jet-cutting etc.) will be also mentioned.

In section 3 research efforts aimed for better understanding of the cavitation phenomena by means of theoretical (CFD) and experimental (flow visualisation) techniques will be outlined. Particular attention will be paid to the problem of mitigation the detrimental cavitation effects and assessment of material resistance to cavitation erosion. The audience will be informed about the International Cavitation Erosion Test projects and efforts aimed to correlate cavitation intensity with the cavitation erosion progress.