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Contributions to some cavitation problems in turbomachinery

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Abstract. In the present article, three problems associated with cavitation in turbomachinery are discussed. The first one deals with the potential application of recent understanding in cavitation inception to similar problems in turbomachinery. The second considers the thermodynamic effects in developed cavitation. This has relevance to turbopump operation using fluids other than water. Old correlations to predict the above effect are summarized and a new correlation is proposed. Lastly, the possible methodology to predict pump cavitation noise is outlined. This section relies heavily on similar developments in propeller cavitation noise research.

Keywords. Turbomachinery; cavitation; thermodynamic effects; noise.

1. Introduction

The problem of cavitation, which is local vaporization in liquid flows due to reduction in static pressure, and its association with turbomachinery, is an old one. In general, cavitation is to be avoided since it can result in material damage, loss in performance, inducement of vibration and intense noise radiation over a wide frequency band. In some special applications, another deleterious effect due to cavitation could be the change of chemical composition of the original liquid sample. Therefore, it is understandable that considerable efforts are still being expended in trying to tackle the problem of cavitation in turbomachinery flows, since even the rudimentary problem of prediction of the conditions for the onset of some of the physical effects due to cavitation as noted above is far from solution.

One of the commonly used methods for assessing the potential occurrence of cavitation in a prototype turbomachine is through model-testing in a suitable facility. In order to conduct the tests properly and extrapolate the findings to prototype conditions, it is necessary to establish proper scaling laws. It is most convenient to do this through the use

A list of symbols is given at the end of the paper