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DETECTION AND MONITORING OF PROPELLER CAVITATION NOISE USING HIGHER ORDER SPECTRAL ANALYSIS

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ABSTRACT. One way of monitoring of inception of cavitation is by measuring the sudden increase in noise level accompanied by extra frequency components in the spectra. This type of monitoring does not tell about the hydrodynamic flow structure of cavitation volume which is generated by a set of propeller blades as they rotate at certain speed and beyond. HOS techniques are used to understand various non-linear processes that happen in propeller cavitation noise manifestation. In this paper, three metrics viz QPC In, Ic and Ave Ic have been proposed to quantify the magnitude of cavitation inception above certain threshold values.

1. Introduction

Acoustic Cavitation in simple terms is the production of small vapour-containing bubbles or cavities in a liquid under the influence of an external pressure field. The pressure field can be high power acoustic field or high power hydrodynamic field. For example, in ultrasonic cleaning applications, high power ultrasonic sounds are used to create cavitation. Similarly in underwater acoustics, sonars transmit high power acoustic energy of the order of 10KW which produces cavitation near the surface of the transducer. On the other hand while designing ship propellers, it is found that high fluctuating hydrodynamic fields which accompany rotating propeller blades can be a source of severe cavitation and thereby high cavitation noise. In all these cases, through pulsation and collapse, cavitating bubbles are secondary sources of sound. By using a hydrophone, acoustic radiation from a cavitating environment can be detected as sudden increase in the noise level.