CFD analysis of cloud cavitation on three tip-modified propellers with systematically varied tip geometry - DTU Orbit (23/04/2019)

The blade tip loading is often reduced as an effort to restrain sheet and tip vortex cavitation in the design of marine propellers. This CFD analysis demonstrates that an excessive reduction of the tip loading can cause cloud cavitation responsible for much of noise and surface erosion. Detached eddy simulations (DES) are made for cavitating flows on three tip-modified propellers, of which one is a reference propeller having an experimental result from a cavitation tunnel test with a hull model, and the other two are modified from the reference propeller by altering the blade tip loading. DES results have been validated against the experiment in terms of sheet and cloud cavitation. In DES, non-uniform hull wake is modelled by using the inlet flow and momentum sources instead of including a hull model. A 4-bladed Kappel propeller with a smooth tip bending towards the suction side is used as the reference propeller. For the reference propeller, sheet cavitation extends over a whole chord length in the hull wake peak. As the blade gets out of the wake peak, the rear part of sheet cavity is detached in a form of cloud cavitation. For the reference propeller, the tip pitch reduction from the maximum is about 35%. When decreasing the tip pitch reduction to 10%, tip vortex cavitation is formed and cloud cavitation is significantly weakened. When increasing the tip pitch reduction to 60%, sheet cavitation slightly moves to inner radii and cloud cavitation grows larger.

General information
Publication status: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, MAN Diesel and Turbo
Contributors: Shin, K. W., Andersen, P.
Number of pages: 5
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Physics: Conference Series
Volume: 656
Article number: 012139
ISSN (Print): 1742-6596
Ratings:
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.35 SJR 0.252 SNIP 0.374
Web of Science (2015): Indexed yes
Original language: English
Electronic versions:
document231220141.pdf
DOIs:
10.1088/1742-6596/656/1/012139

Bibliographical note
Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Source: Findit
Source-ID: 2289558911
Research output: Contribution to journal › Conference article – Annual report year: 2015 › Research › peer-review