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侧斜与负载对螺旋桨无空化和空化水动力性能的影响

Effects of skew and load on propeller non-cavitation and cavitation hydrodynamic performances

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中文关键词： 螺旋桨 空化初生 推力崩溃 侧斜 负载

英文关键词:propeller cavitation initial inception thrust breakdown skew load

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中文摘要:

为了定量分析空化初始航速的影响因素,首先分析侧斜和负载对螺旋桨无空化和有空化时性能的影响。以NSRDC 4381无侧斜桨和4383 100%侧斜桨为对象,采用改进Sauer空化模型和修正SST湍流模型,对空化崩溃性能、空化初生性能和无空化时正车、倒车以及紧急倒车敞水性能进行了计算与比较。结果表明,预报两个桨的敞水性能曲线和多空化数下的空化崩溃性能曲线均与实验值吻合较好。在中度负载区间(J=0.5~0.9)内,侧斜对正车和紧急倒车时敞水性能以及空化时推力和力矩崩溃性能均无明显影响,但会使倒车敞水性能显著下降。在重载和轻载条件下,侧斜均能明显改善空化初生性能。侧斜一定时,负载会直接影响尾流湍流速度脉动量和涡核集中区分布,影响轴面速度流管收缩程度,进而影响无空化和有空化条件下的推进性能。

英文摘要:

Effects of skew and load on propeller non-cavitation and cavitation hydrodynamic performances were presented to quantitative analysis of the effects on cavitation inception speed.Exactly,the cavitating breakdown performances,cavitation inception characteristics,and the forward,backward and crashbacking open water performances under non-cavitation conditions of both NSRDC4381 no skew propeller and 4383 100% skewed propeller were simulated with improved Sauer cavitation model and modified shear stress transport turbulence model.Results show that calculated open water performances and thrust and torque coefficients versus advance ratio over a range of cavitation indices for both of the two propellers are all got successful validation against experiment.The effects of skew on forward and crashback open water performances and cavitating breakdown characteristics are negligible over the range of moderately loads (J=0.5~0.9),but substantially declines the backward performances.Under heavy and light loading conditions,the skew can both elevate the inception performances significantly.Given the skew,the load will directly influence the wake turbulent velocity fluctuation and vortex center,and the axial velo-city streamtube shape,so to the non-cavitation and cavitation propulsion performances.

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