

ABSTRAK

FAUZA RIKZAL GHANI. Analisis Variasi *Stern Foil* Terhadap Hambatan (*Resistance*) Dan Olah Gerak (*Seakeeping*) Pada Kapal Patroli Dengan Metode *Computational Fluid Dynamics* (CFD). Dibimbing oleh EKO PRAYETNO dan ANTON HEKSO YUNianto.

Kapal patroli lepas pantai (Offshore Patrol Vessel/OPV) beroperasi pada kondisi laut yang dinamis sehingga memerlukan efisiensi hidrodinamika dan karakteristik olah gerak yang baik. Salah satu upaya peningkatan performa kapal adalah pemasangan stern foil pada bagian buritan untuk mengurangi hambatan dan memperbaiki respon gerak kapal. Penelitian ini bertujuan menganalisis pengaruh variasi stern foil dengan profil NACA 64-212, NACA 4412, dan NACA 2412 terhadap hambatan total dan performa seakeeping kapal patroli OPV 70 m. Analisis dilakukan menggunakan metode *Computational Fluid Dynamics* (CFD) untuk mengevaluasi hambatan dan respon gerak kapal. Simulasi dilakukan pada kecepatan operasi 20 knot (Froude number 0,418) dengan kondisi gelombang sea state 4 dan arah datang gelombang head seas (180°). Parameter seakeeping dianalisis menggunakan Response Amplitude Operator (RAO) untuk gerakan heave dan pitch pada kondisi gelombang reguler dan irregular. Hasil penelitian menunjukkan bahwa pemasangan stern foil mampu menurunkan hambatan total kapal secara signifikan. Profil NACA 2412 memberikan penurunan hambatan terbesar sebesar 14,85%, diikuti oleh NACA 64-212 sebesar 14,70% dan NACA 4412 sebesar 11,67%. Selain itu, stern foil efektif mereduksi respon gerakan pitch di sekitar frekuensi dominan gelombang, sementara pengaruhnya terhadap gerakan heave relatif terbatas. Hasil ini menunjukkan bahwa penerapan stern foil dapat meningkatkan efisiensi hidrodinamika dan performa operasional kapal patroli.

Kata kunci: kapal patroli lepas pantai; stern foil; hambatan; seakeeping; CFD.

ABSTRACT

FAUZA RIKZAL GHANI. Analysis of Stern Foil Variations on Resistance and Seakeeping Performance of a Patrol Vessel Using Computational Fluid Dynamics (CFD). Supervised by EKO PRAYETNO and ANTON HEKSO YUNianto.

Offshore Patrol Vessels (OPVs) operate under demanding sea conditions and therefore require high hydrodynamic efficiency and adequate seakeeping performance. The application of a stern foil at the aft section has been proposed as an effective solution to reduce resistance and improve vessel motion characteristics. This study investigates the influence of stern foil variations using NACA 64-212, NACA 4412, and NACA 2412 profiles on the total resistance and seakeeping performance of a 70 m Offshore Patrol Vessel. Numerical analyses were conducted using Computational Fluid Dynamics (CFD) to evaluate resistance and motion responses. Simulations were performed at an operational speed of 20 knots (Froude number 0.418) under sea state 4 conditions with head seas (180° wave heading). Seakeeping performance was assessed through the Response Amplitude Operator (RAO) of heave and pitch motions under regular and irregular wave conditions. The results indicate that the installation of stern foils leads to a significant reduction in total resistance. The NACA 2412 profile achieved the highest resistance reduction of 14.85%, followed by NACA 64-212 (14.70%) and NACA 4412 (11.67%). In addition, stern foils effectively reduced pitch motion responses around the dominant wave frequency, while their effect on heave motion was relatively limited. These findings demonstrate that stern foil implementation can enhance hydrodynamic efficiency and improve the operational performance of patrol vessels.

Keywords: Offshore patrol vessel; stern foil; resistance; seakeeping; CFD.