ANALISIS *COMPUTATIONAL FLUID DYNAMIC* PADA VARIASI BENTUK *NOZZLE* DAN TEKANAN BALIK DI BERBAGAI TIPE *NOZZLE* PADA SISTEM PROPULSI *HIGH-PRESSURE WATERJET*

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ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh variasi panjang *Nozzle* dan rasio l/d terhadap *thrust*, *velocity*, *flow coefficient*, dan *hydraulic loss* pada sistem *Waterjet* AUV. Metode yang digunakan adalah simulasi *Computational Fluid Dynamics* dengan variasi geometri *Nozzle* meliputi Conical *Nozzle*, Cos *Nozzle*, dan Exponent *Nozzle* pada panjang 40 mm, 60 mm, dan 90 mm. Selanjutnya dilakukan variasi rasio l/d berdasarkan hasil tertinggi variasi panjang sebesar 1, 1/2, 1/3, dan 1/4 pada berbagai kondisi *back pressure*. Hasil simulasi menunjukkan bahwa Cos *Nozzle* dengan panjang 90 mm menghasilkan *thrust* dan *velocity* tertinggi sementara pada variasi rasio l/d, rasio 1/3 memberikan performa paling optimal dengan *thrust* tinggi, nilai *Flow coefficient* yang stabil, serta *hydraulic loss* yang kecil, terutama pada kondisi *back pressure* rendah. Penelitian ini menyimpulkan bahwa konfigurasi Cos *Nozzle* dengan panjang 90 mm dan rasio l/d sebesar 1/3 yang dioperasikan pada *back pressure* rendah direkomendasikan untuk meningkatkan efisiensi hidrodinamik dan performa propulsi sistem *Waterjet* pada AUV.

Kata Kunci: Propulsi *High Pressure Waterjet*, Optimasi *Nozzle*, CFD

COMPUTATIONAL FLUID DYNAMICS ANALYSIS OF NOZZLE SHAPE VARIATIONS AND BACK PRESSURE IN VARIOUS NOZZLE TYPES IN HIGH-PRESSURE WATERJET PROPULSION SYSTEMS

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ABSTRACT

This study aims to analyze the effect of Nozzle length and l/d ratio variations on thrust, velocity, flow coefficient, and hydraulic loss in an AUV Waterjet system. The method used is Computational Fluid Dynamics simulation with Nozzle geometry variations including Conical Nozzle, Cos Nozzle, and Exponent Nozzle at lengths of 40 mm, 60 mm, and 90 mm. Next, variations in the l/d ratio were made based on the highest results of the length variation of 1, 1/2, 1/3, and 1/4 under various back pressure conditions. The simulation results showed that the Cos Nozzle with a length of 90 mm produced the highest thrust and velocity, while in the l/d ratio variation, the 1/3 ratio provided the most optimal performance with high thrust, stable Flow coefficient values, and small hydraulic losses, especially under low back pressure conditions. This study concludes that the Cos Nozzle configuration with a length of 90 mm and an l/d ratio of 1/3, operated at low back pressure, is recommended to improve the hydrodynamic efficiency and propulsion performance of the Waterjet system on AUVs.

Keywords*: High Pressure Waterjet Propulsion, Nozzle Optimization, CFD*