

“RANCANG BANGUN SISTEM KESTABILAN KAPAL MENGGUNAKAN *FIN* *STABILIZER* DENGAN METODE *FUZZY*”

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ABSTRAK

Keseimbangan kapal sangat dibutuhkan dalam pengoprasian kapal saat ini. Penelitian ini bertujuan merancang dan mengembangkan sistem kestabilan kapal menggunakan fin stabilizer dengan metode *fuzzy*. Sensor mpu6050 digunakan untuk mengukur sudut kemiringan badan kapal, dengan hasil yang menunjukkan akurasi yang baik, selisih rata-rata $0,65^\circ$ dibandingkan aplikasi inclinometer digital. Prototype kapal monohull yang dikembangkan mampu berkomunikasi melalui web dan memonitoring sudut kemiringan roll dan pitch secara *real-time*. Pengujian metode *fuzzy* dilakukan dengan mengukur sudut fin dan respon waktu pergerakan *fin*. Metode *fuzzy* menunjukkan persentase *error* kiri 3,95% dan *error* kanan 4,99%, serta rata-rata respon waktu *fin* bergerak 2,46 detik. Pengujian stabilitas menunjukkan bahwa *fin stabilizer* lebih efektif dibandingkan tanpa *fin*, dengan selisih waktu respon 0,98 detik di tempat penyangga dan 1,76 detik di perairan bergelombang. Di air tenang, kemiringan manual 30° dan 20° menghasilkan selisih waktu respon masing-masing 0,1773 detik dan 0,1732 detik. Di perairan bergelombang, pengujian di Pelabuhan Timur, Madura, menunjukkan rata-rata selisih waktu respon 1,95 detik di pagi hari, 1,332 detik di siang hari, dan 1,66 detik di malam hari. Namun, *fin stabilizer* hanya efektif pada ombak kecil dan gagal pada ombak besar karena keterbatasan gaya angkat sirip. Pengujian referensi menunjukkan bahwa gerak *fin* dari jurnal lebih baik dalam menyeimbangkan kapal sebesar 1,215 detik dibandingkan dengan *fin* yang dikembangkan penulis.

Kata kunci: *Fin stabilizer*, sensor mpu6050, *Internet of Things (IoT)*.

**“DESIGN AND CONSTRUCTION OF A SHIP'S STABILITY SYSTEM USING FIN
STABILIZER WITH THE FUZZY METHOD”**

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ABSTRACT

Ship balance is very necessary in ship operations today. This research aims to design and develop a ship stability system using a fin stabilizer with the fuzzy method. The mpu6050 sensor was used to measure the tilt angle of the ship's hull, with results showing good accuracy, an average difference of 0.65° compared to the digital inclinometer application. The monohull ship prototype developed is capable of communicating via the web and monitoring roll and pitch angles in real-time. Fuzzy method testing is carried out by measuring the fin angle and the response time of the fin movement. The fuzzy method shows a left error percentage of 3.95% and a right error of 4.99%, and an average fin moving response time of 2.46 seconds. Stability testing shows that the fin stabilizer is more effective than without fins, with a response time difference of 0.98 seconds in support and 1.76 seconds in wavy waters. In still water, manual tilts of 30° and 20° resulted in response time differences of 0.1773 seconds and 0.1732 seconds, respectively. In rough waters, testing at East Harbor, Madura, showed an average response time difference of 1.95 seconds in the morning, 1.332 seconds in the afternoon, and 1.66 seconds at night. However, fin stabilizers are only effective in small waves and fail in large waves due to the limited lifting force of the fins. Reference testing shows that the fin movement from the journal is better in balancing the ship by 1.215 seconds compared to the fin developed by the author.

Keywords: *Fin stabilizer, mpu6050 sensor, Internet of Things (IoT).*