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## Seakeeping Behavior of Axe Bow Patrol Boat with the Variation of Waterline Spline Type and Submerged Bow Depth

Aulia Windyandari<sup>(1)</sup>, Adi Kurniawan Yusim<sup>(2)</sup>, Rizaldy Ilham<sup>(3)</sup>, Ahmad Fauzan Zakki<sup>(4\*)</sup>

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DOI: <https://doi.org/10.15866/irea.v11i1.21741>

### Abstract

As a sovereign maritime country, Indonesia has been supported with patrol boats to maintain, protect, and manage the fishery and marine resources. Therefore, enhancing the patrol boat's operability is essentially needed for improving the resources maintenance and protection system. The implementation of an advanced hull forms might be conducted for the improvement of boat performance. The axe-bow hull form is one of the advanced hull forms that might improve the patrol boat operability, especially in high-speed conditions ( $Fr < 0.60$ ). However, in order to determine a reliable axe bow hull form, the body lines and the submerged bow depth should be defined appropriately. Based on the condition, this study focuses on the investigation of seakeeping performance of the developed axe-bow hull forms with variations of waterline spline type and submerged bow depth (the depth of foot). The waterline spline type configurations, which consist of the concave spline, convex spline, and straight spline, have been developed. At the same time, the submerged bow depths configuration have been proposed as 30%, 40%, and 50% of the boat draught. Both parameters should be recognized for the improvement of the axe bow hull seakeeping performance. The strip theory method has been adopted for the calculation of the seakeeping behavior. The results show that the waterline spline type has influenced the heave motion behavior. Otherwise, the larger depth of root might improve the pitch motion performance. It is indicated that suitable combination of spline type and depth of root might generate a reliable seakeeping performance of the axe-bow patrol boat.

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### Keywords

Seakeeping Behavior; Axe-Bow Hull; Spline Type; Submerged Bow Depth

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## Relativistic Problem of Two Bodies

Kamal Sheikhyounis<sup>(1\*)</sup>, Nikolai Tsapenko<sup>(2)</sup>

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DOI: <https://doi.org/10.15866/irea.v11i1.22231>

## Abstract

This paper presents a developed theory of gravitational interaction of two-point bodies that takes into account the finiteness of the speed of light. The relativistic inertial (or gravitational) mass has been determined. The relativistic force of inertia, whose value is invariant to the Lorentz transformation, has been determined. A generalized form of the law of universal gravitation is presented, such that the gravitating masses in it contain corrective relativistic multipliers. Based on these new definitions, a method similar to that of classical mechanics is used to calculate a relativistic orbit of circulation. A new formula for the angle of displacement of perihelion, which takes into account both the value of the focal parameter and the eccentricity of the orbit, and which for the planet Mercury gives the correct numerical result, has been derived.

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## Keywords

Relativistic Mass; The Relativistic Force of Inertia; The Relativistic Orbit; Perihelion Displacement; Mercury

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# Simulation and Numerical Investigation of the Effect of Temperature and Defect on ZnTe/ZnSe/ZnO Thin-Film Photovoltaic Solar Cell Performance Efficiency

Samer H. Zyoud<sup>(1)</sup>, Ahed H. Zyoud<sup>(2\*)</sup>

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DOI: <https://doi.org/10.15866/irea.v11i1.20839>

## Abstract

Thin film-based solar cell semiconductor emerges as a promising candidate for solar photovoltaic future applications. A proposed heterojunction ZnTe/ZnSe/ZnO thin film-based solar cell has been simulated by using Solar Cell Capacitance Simulator-One Dimension (SCAPS-1D) in order to study the impact of temperature and defect layers on its efficiency parameters. The heterojunction thin film-based solar cell has been selected for simulation due to its low cost, availability, and reduced toxicity compared to other absorber layer materials. Numerical modeling has been used to comprehend device properties before fabrication. The results indicate that the efficiency parameters (Jsc, VOC, FF, and  $\eta$ ) have been significantly affected by temperature and the presence of defect layers. The simulated J-V characteristics demonstrate how defect density affects solar cell efficiency parameters. In the defect system, the efficacy parameters have been reduced except for a slight increase in VOC at 300 K. The findings of this study are significant as they demonstrate the importance of understanding the impact of temperature and defect layers on the performance of thin film-based solar cells. The use of numerical modeling tools like SCAPS-1D can aid in the design and development of new solar cell technologies, which could ultimately lead to the widespread adoption of solar energy as a clean and sustainable energy source.

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Thin Film Solar Cell; ZnTe/ZnSe/ZnO; SCAPS-1D; Defect; Bandgap

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## Combined Fuzzy-PID Controller of an Inertial Stabilized Platform

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### Abstract

An Inertially Stabilized Platform (ISP) is used when certain sensors are meant to be stable around a required orientation regardless of any movements of the carrier platform. ISPs are essential for vision-guided flying vehicles to stabilize the equipped seeker attached to the guided vehicle body for efficient target tracking and guidance. This work aims to design a suitable and robust controller for an ISP that can mitigate the disturbances and noise expected when attached to a guided vehicle seeker system. The ISP system is modeled, designed, and implemented. To overcome system uncertainties, external disturbances, and coupling, an efficient controller is to be designed to meet stability and performance requirements. In this research, a decoupled dynamic modelling of a two-axis ISP while accounting for system uncertainties is introduced. In addition to that, a combined fuzzy-PID controller is designed. To evaluate the proposed system's performance, a series of experiments based on two axes and transformations between two frames are carried out. The proposed controllers are compared to traditional PID controllers. The simulation and laboratory tests show the high performance achieved by the proposed combined fuzzy-PID controller for the designed ISP, where better robustness, transient response, and steady-state error are obtained when compared to the conventional controllers.

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### Keywords

Inertia Stabilized Platform; Gimbal System; Rate Gyroscope; Fuzzy-PID Controller

### Full Text:

PDF

### References

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