

Review

Numerical Methodologies for the Analysis of Horizontal-Axis Floating Offshore Wind Turbines (F-HAWTs): A State-of-the-Art Review

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Abstract: In recent decades, wind turbine installations have become a popular option to meet the world's growing demand for energy. Both onshore and offshore wind turbines form pivotal components of the electricity sector. Onshore wind energy is now a mature technology, with significant experience gained by wind farm developers and operators over the last couple of decades. However, as a more recent enterprise, the offshore wind industry still requires significantly more development before the technologies and operations reach maturity. To date, floating platforms at sea have been utilised extensively for the oil and gas industry. While a lot of the expertise and technology is transferable to the floating offshore wind industry, significant development work remains; for example, there is significant work required due to the different device types. Compared to floating oil and gas platforms, floating wind turbine platforms have a higher centre of gravity, which influences their performance and complexity. The successful large-scale development of floating offshore wind farms will require significant expertise and learning from the onshore wind, oil, and gas sectors. There are a wide range of software packages available to predict the operational behaviour of floating offshore wind turbines. In spite of this, it is still extremely difficult to create a fully coupled model of a floating wind turbine that can accurately and comprehensively model the turbine aerodynamics, hydrodynamics, servodynamics, structural dynamics, and mooring dynamics. This paper presents details on various fully coupled and uncoupled software packages and methodologies utilised to simulate floating offshore wind turbine performances. Various kinds of mooring systems, floating wind turbines, analysis methods, and experimental validation methods are comprehensively described. This paper serves as a reliable methodological guideline for researchers and wind industry professionals engaged in the design/analysis of wind farm projects.

Keywords: floating offshore wind turbine (FOWT); F-HAWT; marine renewable energies; mooring system; numerical evaluation; fully coupled analysis; uncoupled analysis



Academic Editors: Nevion Dacic, Qingan Li, Junlei Wang, Dongnan Song, Minghua Tang and Xiaojiao Chen

Received: 26 October 2024
Revised: 8 December 2024
Accepted: 17 December 2024
Published: 24 December 2024

Citation: Akbari Zadeh, N.; Ryan, P.; Kennedy, D.M.; O'Rourke, F. Numerical Methodologies for the Analysis of Horizontal-Axis Floating Offshore Wind Turbines (F-HAWTs): A State-of-the-Art Review. *Energies* **2025**, *18*, 22. <https://doi.org/10.3390/en18010022>

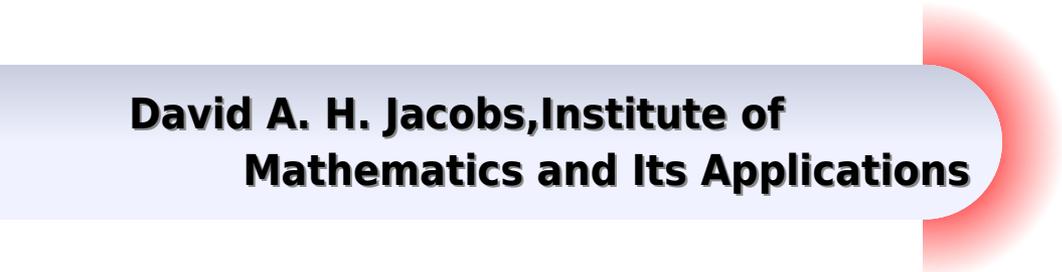
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1. Introduction

The energy crisis, global warming, and security-of-supply concerns have prioritised renewable energy development globally. Increasing energy prices and supply concerns, in addition to recent political instability, have made the need for the transition to new energy technologies and fuels tangible for society. This development has led to the increased

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**David A. H. Jacobs, Institute of
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analysis *Electricity from Photovoltaic Solar Cells: High-efficiency solar cells* ,1986 Computer Aided Design of Multivariable Technological Systems G. G. Leininger,2014-05-16 Computer Aided Design of Multivariable Technological Systems covers the proceedings of the Second International Federation of Automatic Control IFAC The book reviews papers that discuss topics about the use of Computer Aided Design CAD in designing multivariable system such as theoretical issues applications and implementations The book tackles several topics relevant to the use of CAD in designing multivariable systems Topics include quasi classical approach to multivariable feedback system designs fuzzy control for multivariable systems root loci with multiple gain parameters multivariable frequency domain stability criteria and computational algorithms for pole assignment in linear multivariable systems The text will be of great use to professionals whose work involves designing and implementing multivariable systems *Mathematics of Computation* ,1978 Original articles on all aspects of numerical mathematics book reviews mathematical tables and technical notes Covers advances in numerical analysis application of computer methods high speed calculating and other aids to computation

The book delves into State Of The Art In Numerical Analysis. State Of The Art In Numerical Analysis is a vital topic that needs to be grasped by everyone, from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into State Of The Art In Numerical Analysis, encompassing both the fundamentals and more intricate discussions.

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- Chapter 1: Introduction to State Of The Art In Numerical Analysis
- Chapter 2: Essential Elements of State Of The Art In Numerical Analysis
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- Chapter 4: State Of The Art In Numerical Analysis in Specific Contexts
- Chapter 5: Conclusion

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6. In chapter 5, the author will draw a conclusion about State Of The Art In Numerical Analysis. The final chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of State Of The Art In Numerical Analysis.

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