Machine Learning Techniques for Computational Fluid Dynamics

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Abstract. This article examines the integration of machine learning techniques into computational fluid dynamics (CFD) to enhance predictive accuracy and computational efficiency. Machine learning models, trained on vast datasets of fluid dynamics simulations, can offer new insights and improve the performance of traditional CFD methods. This research highlights the synergy between data-driven models and classical physics-based approaches, providing a comprehensive overview of current methodologies and future prospects. The results indicate significant potential for machine learning to revolutionize the field of CFD.

Keywords: Machine Learning, CFD, Efficiency, Integration, Predictive Accuracy

Introduction

Computational Fluid Dynamics (CFD) is a critical tool in the analysis and simulation of fluid flows. Traditionally reliant on physics-based models, CFD has seen substantial advancements through the integration of machine learning techniques. Machine learning offers the ability to process large datasets and identify complex patterns that might be overlooked by conventional methods. This paper explores the various machine learning techniques applied to CFD, including supervised and unsupervised learning models. We discuss their implementation, advantages, and the challenges faced in the integration process. By examining case studies and current applications, this research provides a comprehensive overview of how machine learning can enhance CFD's accuracy and efficiency. The findings underscore the transformative potential of this interdisciplinary approach, setting the stage for future innovations in fluid dynamics.

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References

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