A Hybrid Ai-Driven Integral Transform Framework for Nonlinear Differential Equations in Engineering Systems

Amarender Reddy Kommula
Lecturer in Mathematics, Department of Computing & Informatics, Mazoon College, Oman

Abstract:

Integral transforms such as the Laplace, Fourier, and Mellin transforms have traditionally helped engineers simplify complex differential equations. However, when systems become nonlinear or involve irregular physical conditions, these classical tools lose their accuracy and stability. To bridge this gap, this paper presents an AI assisted hybrid integral transform framework. The framework automatically adjusts transform kernel parameters, improves convergence, and stabilizes the inverse process. Through case studies involving nonlinear heat transfer, viscous fluid flow, and thermoelastic wave propagation, the proposed model demonstrates 35–40% improvement in accuracy. The analysis confirms that AI driven kernel adaptation significantly enhances the practical usability of integral transforms for advanced engineering problems.

Keywords:

Integral Transforms, Artificial Intelligence, Adaptive Kernel Optimization, Nonlinear Differential Equations, Engineering Applications.