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PhIGT: Physics Informed Graph Transformer for Planar Cable-Driven Parallel Robot Forward Kinematics

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Abstract

Neural networks (NNs) have made significant progress in recent years, achieving impressive results in a wide range of applications. However, many of these models do not take advantage of the rich physical knowledge available from prior studies and domain expertise, especially in the field of robotics. To bridge this gap, Physics-Informed Neural Networks (PINNs) have emerged as a powerful framework, enabling the integration of physics information with various types of neural networks. This approach has gained popularity due to its ability to leverage physical laws, improve generalization, and enhance learning efficiency. In this paper, we propose a Physics-Informed Graph Transformer Network (PhIGT) for implementation on a cable-driven parallel robot to solve the forward kinematics problem. By incorporating physical constraints into the graph-based transformer architecture, our approach aims to achieve more accurate and physically consistent predictions for the cable robot's end-effector positions, offering a novel solution that effectively combines data-driven learning with domain-specific physics.

Keywords: Physics Informed Neural Network, Graph Neural Network, Transformer, Forward Kinematics, Planar Cable-Driven Parallel Robot

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