K. K. Wagh Institute of Engineering Education and Research

Department of Robotics & Automation

Technical News Letter

April 2023 of AY 2022-23

It's a great pleasure to present our newsletter for the April 2023 of AY 2022-23. Department of Robotics & Automation has been consistently endeavoring to upgrade the skills and performance of students and staff members through various ventures.

❖ Expert lectures attended by staff

02 expert lectures attended by the teaching and non- Teaching staff.

Sr. No.	Title of lecture	Name of Speaker	Name of Industry	Date	No. of Student Present
1	PCB Design	Mr. Chetan S. Jadhav	Hi-Q Electro Systems, Nashik	1-04-2023	83
2	Supply Chain Management & Analytics	Mr. Rohan U. Katkade	GXO Logistics Ltd; Nashik	15-04-2023	61

Online Webinar attended by the faculty

In the month of the April 2023 teaching and non - Teaching staff member attended various webinar on online platform to explore the new advancement in the technology.

❖ Student Activities

Students Association of Robotics & Automation (SARA) organized a competition INFINITY 2K23 on Friday, 28th April 2023 and Saturday 29th April 2023.

❖ Staff Activities

Dr. P. J. Pawar published a Research paper titled "Minimizing cycle time and energy consumption for a multi-degree serial manipulator using teaching–learning-based optimization", Journal of the Brazilian Society of Mechanical Sciences and Engineering, 45, 263 (2023). https://doi.org/10.1007/s40430-023-04192-z (IF: 2.361)

Minimizing cycle time and energy consumption for a multi-degree serial manipulator using teaching–learning-based optimization

Abstract

Multiple inverse kinematic solutions are obtained for a multi-degree serial manipulator. Each solution provides a different cycle time and energy consumed to perform a given task in a particular sequence. Improper selection of inverse kinematic solution in a robotic assembly line may lead to an increase in not only overall cycle time but also energy consumption. Therefore, it is necessary to optimize the robot's performance with respect to cycle time and energy consumption simultaneously. These two objectives usually conflict due to joint motors' different operational speeds and energy consumption rates. Hence, in this work, an attempt is made to simultaneously optimize both cycle time and energy consumption by minimizing the differences in joint angles of the robot manipulator while moving from one position to another in applications involving multi-point movement of the robot end effector. The proposed approach is demonstrated by considering an example of a commonly used six-degree-of-freedom Kuka KR5-A robot manipulator. It can be extended efficiently for any other robot manipulator.

A relatively new algorithm known as teaching–learning-based optimization (TLBO) algorithm is employed to solve this problem. It is observed that the results obtained by TLBO show a significant reduction of about 20% and 10% for cycle time, while 3% and 15% for energy consumption over the results obtained by genetic algorithm (GA) and sequential quadratic programming (SQP), respectively.

Dr P. J. Pawar published a book chapter titled: "Trajectory Optimization of an Industrial Robot Using Teaching–Learning-Based Optimization" In Advanced Engineering Optimization through Intelligent Techniques. Lecture Notes in Mechanical Engineering. Springer, Singapore. https://doi.org/10.1007/978-981-19-9285-8_63

Abstract

In this work, a teaching–learning-based optimization technique is applied to control the industrial robot arm trajectory based on an inverse kinematics solution with energy consumption minimization. The problem considers the minimization of energy consumption during the process sequence of six degrees of freedom industrial robot. The assessment of energy criteria includes the computational modeling of the movement of the robotic arm. The considered technique is compared and validated on the industrial robot ABB IRB 1410 for trajectory optimization.

Dr. P.J. Pawar
Head of the Department