

CSE438 Task 2

Calibration of Serial Robots through Integration of Local POE Formula and Artificial Neural Networks

Introduction –

- **Motivation –**

In the research paper, the authors talked about the robotic manipulators that have been in use for a long time but yet to reach the absolute pose accuracy which hampers the work complexity and causes to waste lots of time.

- **Contribution-**

In order to streamline the error modeling process while preserving accuracy, the authors proposed utilizing both model-based and data-driven methods on an equivalent robot. The authors worked using Artificial Neural Networks with the physical implementation product-of-exponentials formula.

- **Methodology-**

An equivalent robot has been calibrated by preserving only joint motion errors that makes the local POE-based error model more straightforward. Then the method is used where it combines the approximation of the complex relationship between joint motion errors and nominal joint variables with the strengths of neural networks as universal approximators. After the pose measurements, neural network training is placed in work. Designing a joint error compensator can be used to perform online error compensation once neural networks have been trained.

- **Conclusion-**

The approach suggested by the authors, which is based on neural network training, reduces maximum pose errors and standard deviations more effectively than the local POE-based method, which results in notable increases in posture accuracy.

Limitations-

1. **First Limitation-**

It is still difficult to modify the procedure for parallel robots, particularly ones with reduced mobility. Dual space theory and instantaneous screw theory are two suggested mathematical techniques for representing parallel robotics which were not applied in this research

2. **Second Limitation-**

The problem of calibration efficiency needs to be addressed. There is an efficiency issue because the existing random selection method for measuring configurations necessitates a large number of configurations.

Synthesis-

The concepts discussed in the study on the serial robot calibration approach have a number of implications for future developments and possible uses in the robotics and automation fields such as, Opportunities for real-time error compensation are created by the approximation of joint motion faults using artificial neural networks. Using this research, it can be used to further identify areas of investigation to tackle problems particular to various robot types and improve the effectiveness of calibration procedures in practical robotic applications.