

## Intelligent active force control of a 3-RRR parallel manipulator incorporating fuzzy resolved acceleration control

### Abstract:

This paper introduces a novel intelligent control scheme for robust and precise positioning and orientation of a class of highly non-linear 3-RRR (revolute-revolute-revolute) planar parallel manipulator. The primary objective is to force the manipulator to track accurately a prescribed Cartesian trajectory when the system is subjected to different types of disturbances in the forms of forced harmonic excitations. A two level fuzzy tuning resolved acceleration control (FLRAC) is first designed and implemented to the system to demonstrate the stable response of the manipulator in performing trajectory tracking tasks in the absence of the disturbances. In this scheme, the first level of fuzzy tuning is used to acquire the proportional-derivative (PD) gains linearly while the second level considers non-linear tuning for determining the other parameters of the fuzzy controller to increase its performance. Then, the controller is added in series with an active force controller (AFC) to create a novel two degree-of-freedom (DOF) controller known as FLRAC-AFC which is subsequently and rigorously tested for system robustness and accuracy in tracking the prescribed trajectory. The simulation study provides further insight into the potentials of the proposed robotic system in rejecting the disturbances for the given operating conditions. The results clearly show that the FLRAC-AFC scheme provides a much superior trajectory tracking capability compared to the conventional linear RAC alone.