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P2.146 Kinematic calibration for a hybrid redundant robot based on Artificial Bee Colony algorithm

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In the ITER or the future DEMO fusion reactors, due to the neutron activation, the remote handling tasks such as inspection, repair and/or maintenance of in-vessel and ex-vessel components must be carried out using a wide variety of special tailored manipulators. In order to adapt to the complex environment, the accuracy of the manipulators is necessary to be improved. The kinematic calibration for a 10-DOF hybrid redundant serial-parallel robot, which is designed for ITER vacuum vessel remote maintenance, is presented in this paper. As the Kinematics of hybrid serial-parallel robot is complicated both in forward and inverse solutions, and in addition, the error model is high nonlinear, for the calibration the kinematics and error models of the hybrid robot based on the Product of Exponential (POE) formula are created.
In this paper, the artificial bee colony (ABC) optimization algorithm is used to identify the forward and inverse kinematic parameters and renew the error model. The ABC algorithm is a relatively new optimization technique that simulates the behavior of a honeybee swarm. It has the advantages of fewer control parameters and good exploration. The parameters in POE error estimation functions are evaluated by the ABC algorithm. Therefore, the assumption error parameters in the nonlinear model are identified, and the position and orientation of the end-effector are updated to more accurate values. Finally the accuracy of the end-effector is effectively improved. The methods presents in this paper could be extrapolated to the any calibration of remote handling manipulators in ITER or the future DEMO.

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