Light Science & Applications

Kinematic analysis and testing of a 6-PRR-R-RR parallel manipulator

Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China

Ha-si-ao-qi-er Han
Email: hanhasiaoqier@yahoo.com

The Gough-Stewart manipulator has been successfully used in a wide variety of large aperture telescopes. This talk presents a novel 6-DOF parallel manipulator that is used as the third mirror adjustment system of a large space telescope. In order to meet the design requirements of high precision, a large load, a small size, and high stiffness in both the transverse and the vertical directions, the parallel manipulator is designed to be a 6-P-RR-R-RR structure via use of orthogonal non-intersecting RR-joint. A novel methodology is developed to define the dependent RR-joint variables and a numerical algorithm is employed to calculate the joint variables. The inverse kinematics of this manipulator can be solved using Newton–Raphson numerical iterative algorithm. To verify the effectiveness of the proposed approach, simulations are performed with MATLAB and ADAMS packages. A prototype of this manipulator is manufactured. Its zero position, resolution, step accuracy, step repeatability, and motion stroke are measured. It is shown that the presented method is effective for this parallel manipulator.

Short Bio:

Ha-si-ao-qi-er Han is currently an assistant researcher at Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences. He is also a second year PhD candidate in Mechanical Engineering from CIOMP. He joined CIOMP in 2013. From 2005 to 2009, and from 2011 to 2013, he studied at Harbin Institute of Technology. His research interests cover mechanical design, kinematic analysis, stiffness analysis and testing of parallel manipulators.