Kinematic Error Modelling and Error Sensitivity Analysis of A Robot

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ABSTRACT

The application areas for use of robots are increasing. A variety of robots are being developed for different applications and environments. The kinematic, inverse kinematic analysis and the positioning error analysis of a two-axis FPD transfer robot used in the LCD manufacturing industry are studied in this thesis. The kinematic model of the robot is obtained by modeling each linkage as a homogeneous transformation matrix. Therefore the posotion and the orientation of the end effector can be represented as the product of these matrices. However, the position and orientation of the end effector calculated by the homogeneous transformation can be erroneous due to sizing and geometric errors of each link, backlashes in the drive train etc. A new homogeneous transformation that takes these linkage errors into account is developed to calculate the correct position and orientation of the end effector. The model of estimating the sensitivity of positioning error with respect to the linkage error is then proposed. According to the positioning error sensitivity analysis, the influence of each error factor with respect to the position accuracy can be determined. As a result, reasonable tolerance design of the robot linkages that results in high positioning accuracy can be achieved by using these positioning error sensitivity information.

Keywords : homogeneous transformation matrix ; error factor ; positioning error sensitivity analysis

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