Wei, Juan; Zhang, Jianguo; Du, Xiaosong

Interval motion accuracy reliability analysis of manipulators based on Chebyshev inclusion polynomial.  (English)  

Summary: Motion accuracy of space manipulators has direct effects on the ability of the systems to perform specified tasks. However, some design variables are inherently interval parameters due to uncertainties in geometric structures, material properties, and so on. This paper presents Chebyshev inclusion function (CIF) for approximating the dynamic responses function of parametrically excited systems. Motion accuracy reliability (MAR) of space manipulators was evaluated based on mechanism reliability analysis methods and interval uncertainty model. To illustrate the accuracy of the proposed method, a two-link manipulator with interval parameters was demonstrated. The results showed that the proposed method required much fewer samples to obtain more accurate reliability compared with the traditional Monte Carlo simulation. Finally, the sensitivity analysis was performed to facilitate the optimization design by using global sensitivity analysis.

MSC:
62P30 Applications of statistics in engineering and industry; control charts
62N05 Reliability and life testing
90B25 Reliability, availability, maintenance, inspection in operations research

Keywords:
space manipulator; motion accuracy reliability; interval theory; Chebyshev inclusion function

Full Text: DOI