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机械科学

一种四自由度并联机构的性能指标分析

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摘要:
通过改变并联机构的拓扑结构,得到了一种具有空间四自由度的并联机构。根据位置关系方程,通过理论推导,得到了机构速度和加速度映射解析方程,同时求出了机构的一阶和二阶影响系数矩阵。综合分析了机构的运动学和动力学性能指标,得到了影响多种性能指标的敏感因素。考虑量纲的不同,将Jacobian矩阵分离,在动平台任务空间内,研究了决定速度和力、角速度和力矩的性能指标。提出了对Hessian矩阵采用“分层”研究的方式,在任务空间内,得到了各支链扰动对机构加速度和惯性力性能的影响程度。研究结果为机构的设计和优化以及控制策略的选择提供了理论依据。

关键词:
四自由度 影响系数矩阵 性能指标 并联机构

Analyses for Performance Indices of a Four-DOF Parallel Manipulator

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Abstract:
A spatial 4-DOF parallel manipulator was deduced in the event that the topology of parallel manipulator was changed. Based on the equation of position, the mapping analytic equation of velocity and acceleration was built by theoretical derivation, and simultaneously the first and second order influence coefficient matrixes were solved. Performance indexes of kinematics and dynamics were multianalyzed, and the factors that output perturbation affects the sensitivity of inputs perturbation were received. Taking different units into account, a matrix of Jacobian was detached, and then performance indexes of velocity, force, angular velocity and moment were analyzed in task workspace of the motion platform. A method of stratifiedly researching the matrix of Hessian was proposed in order to calculate perturbation of each limp differing in the degree in acceleration and inertial force performance indexes in task workspace of motion platform. The results provide theoretic proof for designing and optimizing the mechanism and choice of control strategy.

Keywords: four DOFszz')" href="#"> four DOFs influence coefficient matrix performance index parallel manipulator

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