6-CPS正交并联机器人位置正解分析 Forward Positional Analysis of 6-CPS Orthogonal Parallel Manipulators

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关键词：　并联机器人 位置正解分析 反馈混沌化 Newton迭代法

摘　要：　根据并联机器人机构结构综合理论，提出了一种6-DOF 6-CPS正交并联机器人机构，并对位置正解进行分析。以机构6条驱动腿的长度为约束条件，建立约束方程，得到了求位置正解的非线性方程组。应用产生或强化混沌系统的反馈混沌化方法——Chen-Lai算法，对离散时间系统施加反馈控制，可得到预期Lyapunov指数和良好遍历性的混沌系统。应用基于反馈混沌化的Newton迭代算法(CBNIA)求解6-CPS正交并联机器人机构正位置分析中的非线性方程组。数值验证表明，CBNIA能够快速求出全部位置正解，且正反解结果十分吻合。A 6-DOF 6-CPS orthogonal parallel manipulator was presented, based on the theory of the structure synthesis for parallel robot mechanisms. The forward kinematics of the manipulator was studied to analyze the positive positional solutions. With the restrict condition of the lengths of six actuated limbs, the constrained equations were established, and the nonlinear equations (NLEs) were obtained to solve forward positional problems of the mechanism. Based on the Chen-Lai algorithm, by means of which chaos was generated or modified, a discrete-time dynamical system was feedback controlled to be transferred to a chaotic system that has the expected Lyapunov exponent and good ergodicity. The chaotification-based Newton iterative algorithm (CBNIA) was utilized to solve NLEs for forward displacement analysis of 6-CPS orthogonal parallel manipulators. The results of numerical verification show that through the CBNIA, all forward solutions can be quickly found that are very coincident with the inverse ones.

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