Zha, Xuan F.

Optimal pose trajectory planning for robot manipulators. (English) Zbl 1062.70584

Mech. Mach. Theory 37, No. 10, 1063-1086 (2002).

Summary: Planning of robot pose trajectory is a very complex task that plays a crucial role in design and application of robots in task space. This paper presents a unified approach to optimal pose trajectory planning for robot manipulators in Cartesian space through a genetic algorithm (GA) enhanced optimization of the pose ruled surface. The robot pose ruled surface is formed as a motion locus of its configuration vector. The unified treatment of the end-effector positions and orientations is based on the robot pose ruled surface concept and used in trajectory interpolations. The planning of robot pose trajectories is accomplished through the way of generating and optimizing robot pose ruled surfaces under the constraints of kinematics, dynamics and control performances. The optimization model is established based on functional analysis and dynamics planning, and instantiated by using high-order parametric space curves as position and orientation trajectories. A GA enhanced optimization method is used to choose the parameters (coefficients) of space curves such that the pose ruled surface and its area and area change ratios are optimized for achieving good kinematics and dynamics performances. With robot's dynamics constraints taken into account, the optimized trajectories are realizable and robust for control. Two cases are studied to verify the feasibility of the proposed approach.

MSC:

70E60 Robot dynamics and control of rigid bodies
70B15 Kinematics of mechanisms and robots
68T40 Artificial intelligence for robotics
92D99 Genetics and population dynamics

Keywords:

control; off-line programming

Full Text: DOI