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TRAJECTORY OPTIMIZATION OF INDUSTRIAL ROBOTS WITH A FEASIBLE DIRECTION INTERIOR POINT ALGORITHM

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Abstract: Trajectory planning is considered a fundamental concern in robotics. In this paper we discuss the use of optimization techniques to obtain optimum trajectories of industrial robots. We use the flexibility of optimization techniques to address different formulations and solve them using the Feasible Direction Interior Point Algorithm (FDIPA). This method essentially solves two linear systems in each iteration to compute a descent and feasible direction of the problem, then performs a line search procedure that assures global convergence and feasibility of all iterates. Initially, it will be discussed point-to-point collision-free paths, that is, given an initial pose of the robot and a final target point, find an optimum trajectory that minimizes time, total displacement, energy or other performance index while avoiding collision with any obstacle. Then we discuss the path-following cases, where, given the desired trajectory of the robot's end-effector, optimum joint trajectories are calculated, concerning objective functions such as minimum velocity or acceleration peaks. In both cases we also deal with joint mechanical limits (maximum displacements, velocities and accelerations) as constraints to the optimization problem. Finally, we use a 4 degrees-of-freedom (DOF) planar manipulator to present numerical examples. Our results prove the effectiveness of the proposed approach and ensure robustness and applicability of the method.