

Synthesis of Balanced 3-RRR Planar Parallel Manipulators

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Abstract : The paper deals with the design of parallel manipulators with balanced inertia forces and moments. The balancing of the resultant of the inertia forces of 3-RRR planar parallel manipulators is carried out through mass redistribution and centre of mass acceleration minimization. The proposed balancing technique is achieved in two steps: at first, optimal redistribution of the masses of input links is accomplished, which ensures the similarity of the end-effector trajectory and the manipulator's common centre of mass trajectory, then, optimal trajectory planning of the end-effector by 'bang-bang' profile is reached. In such a way, the minimization of the magnitude of the acceleration of the centre of mass of the manipulator brings about a minimization of shaking force. To minimize the resultant of the inertia moments (shaking moment), the active balancing via inertia flywheel is applied. However, in this case, the active balancing is quite different from previous applications because it provides only a partial cancellation of the shaking moment due to the incomplete balancing of shaking force.

Keywords : dynamic balancing, inertia force minimization, inertia moment minimization, 3-RRR planar parallel manipulator

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