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OPTIMAL SYNTHESIS OF THE FIVE-BAR LINKAGES WITH SYMMETRICAL STRUCTURE BY USING IMPOSED TRAJECTORIES FOR HOME TRAINING

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Abstract

Post-stroke rehabilitation of the limbs requires equipment with controlled-constraint movement. The paper proposes a rehabilitation system for the upper limb, which is usable in medical facilities but also in home training, based on a five-bar linkage structure. The synthesis method allows the analytical computation of the links length of a symmetrical five-bar linkage in order to avoid the singularities in an imposed dexterous trajectory. The type synthesis of the five-bar linkage shows that the number of symmetrical structures of five-bar linkage is limited to 8 structures, from which the structure 5-RRRRR, 5-RTRTR and 5-TRRRT are application relevant. This study shows the optimization of the novel synthesis method by considering a maximal minimum transmission angle and a maximal manipulability along an imposed trajectory. The minimum transmission angle and the manipulability index value of a linkage can be directly linked to the kinematic performance of a robotic structure and since the five-bar linkage is widely used in rehabilitation and training devices the proposed synthesis method will further contribute to the development of experimental devices.

Key words: five-bar linkage, home training, maximal transmission angle, maximal manipulability, optimization, rehabilitation, synthesis.

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