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DIMENSIONAL SYNTHESIS OF A HYBRID RIGID-FLEXIBLE FOUR-BAR LINKAGE FOR OPEN-PATH GENERATION

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ABSTRACT

Hybrid rigid-flexible mechanism is a mechanism composed of rigid and compliant links [1]. Rigid-body joints and flexibility of bendable rods enable the mobility of the hybrid mechanism. In recent years, these mechanisms have gained popularity thanks to safety, easy interaction and a large range of motion. However, research in the area of dimensional synthesis of hybrid rigid-flexible mechanisms are very scarce. This was the motivation for the authors to investigate this problem more deeply and apply modern optimization techniques in order to solve it.

A hybrid rigid-flexible four-bar linkage whose input link is a continuum tendon of constant curvature, described in [2], was considered.

The authors solved the problem of synthesis of a hybrid rigid-flexible four-bar linkage to generate four different types of open paths. The aim of the dimensional synthesis is to design the geometric parameters of this hybrid mechanism whose coupler point should describe the motion that will follow the path defined by the appropriate number of precision points. At the same time, the deviation of the actual path from the desired one, which is defined by precision points, should be as small as possible. Solving the problem of dimensional synthesis was carried out by applying the optimization procedure. Design variables, objective function and constraints were defined for the considered problem, while a modern metaheuristic algorithms [3] were applied in the optimization process. The efficiency of the applied metaheuristic algorithms was confirmed on four examples of an open-path generation in the dimensional synthesis procedure.

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