A new atlas for 8-bar kinematic chains with up to 3 prismatic pairs using Joint Sorting

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Abstract

It is important for designers of mechanical systems to visualize as many kinematic structures of mechanisms as possible. In this paper, a systematic methodology is proposed to generate all solutions of planar 8-bar kinematic chains (KCs) with up to 3 prismatic (P) pairs. First, a totally automated technique is developed to enumerate all available configurations of prismatic pairs for each KC. Second, Joint Sorting Code (JSC) is introduced for the first time to represent all KCs. Then a Kinematic Chain Structural Matrix (KCSM) is generated for all KCs to solve the problem of isomorphism. Finally, all results are evaluated by considering rules of P-joints assignment introduced by Ref. [1]. A vc++ code has been developed for enumeration, codes generation and isomorphism detection processes. The proposed methodology produces a new atlas for 8-bar chains that contains 16 groups and 48 subgroups. It contains 108, 426 and 816 KCs with 1P, 2P and 3P-joints respectively. The presented technique can be extended to single degree-of-freedom (DOF) planar n-bar chains with simple joints.

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