Enumeration of planar non-fractionated kinematic chains

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ABSTRACT

The conceptual design is the earliest stage of linkage mechanism design where several alternatives are generated and evaluated in order to fulfill functional, structural, and other design requirements [1, 2]. The available automated tools used to search those feasible alternatives satisfying imposed topological constraints for a given problem use previously enumerated and classified atlases of mechanisms obtained from a source of basic kinematic chains. The research on the enumeration of basic kinematic chains started in the mid-sixties [1] using Graph Theory and Group Theory concepts and it is still of mayor importance because the available automated tools to design mechanisms are limited by the size of the kinematic chain atlases. Besides, the performance of current hardware enable the designer to obtain accurate results in shorter times than in the past and to extend the enumeration results compared to old enumeration experiments. The enumeration approach proposed by Tsai [1] divides the problem into contracted graph enumeration, testing of graph isomorphism, expansion of binary chains, and detection of degenerated sub-chains. In this work, the integer equations and constraints for the enumeration of contracted graphs followed by the assignment of binary chains are computationally implemented in the form of recursive algorithms. The list of enumerated contracted graphs is validated against recent results [3] and the computer times are presented. This extended database will benefit researchers and designers with the possibility to explore complex linkage and mechanism atlases automatically.

REFERENCES

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