Exact Path Synthesis of RCCC linkages for a Maximum of Nine Prescribed Positions

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Abstract

This paper addresses the path synthesis of RCCC linkages, a problem that has been left unattended in the literature. Compared with planar and spherical four-bar linkages, a RCCC linkage has many more design parameters, which leads to a complex formulation of the path-synthesis problem and, consequently, to a quite challenging system of algebraic equations. In this paper, the problem is solved with a novel formulation of path synthesis for visiting a number of prescribed positions. This is achieved by means of an alternative coordinate system, with which point coordinates are expressed with the aid of two vectors fixed to the same body. By this means, the rotation matrix used to represent the coupler-link attitude is avoided. Synthesis equations are then formulated in a simple form. The new formulation shows that path synthesis admits exact solutions for up to nine prescribed positions, which proves a landmark claim submitted by Burmester. Examples are included to demonstrate the path synthesis with the method thus developed.

Keywords: Spatial four-bar linkage, nine-point path synthesis, dual algebra, algebraic coupler curve