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Verification of the Higher Order Kinematic Analyses Equations

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Abstract

In this contribution the higher order analyses equations for a kinematic chain are deduced by successive derivation of the velocity analysis equation. In order to simplify the process, a generic expression formed by the Jacobian matrix times a general vector of appropriate dimension is defined. Deriving this expression and forming similar generic expressions, it is possible to obtain first, second and third derivatives of the original expression. From these derivatives, the second -acceleration-, third -jerk- and fourth -jounce- order analyses equations are easily obtained. These equations are compared with those previously obtained by Lerbet and Duffy and his coworkers, and they are found to be in complete agreement. Finally, these expressions are employed to determine the local mobility of three single-loop kinematic chains in singular positions in which most of the techniques for the mobility determination fail. The first example is a kinematotropic linkage. In the second example, the expressions are employed to prove that a seemingly movable linkage is, in reality, a structure; an important detail in this example is that the expressions for the fourth order analysis are required. Finally, a reconfigurable linkage is dealt with, in the third example.

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