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A Systematic Model Reduction Method for the Control of Flexible Multibody Systems

Olivier Bruls(1), Pierre Duysinx(2), Jean-Claude Golinval(1)

(1) *University of Liege – ASMA, Liege, Belgium*
(2) *University of Liege – PROMETHE, Liege, Belgium*

The development of parallel kinematic mechanisms is a major advance in the field of high-speed machine-tools and manipulators. The natural vibration modes may be excited during the fast motions so that the flexible behaviour has a significant influence on the performances. In order to drive those complex mechanisms efficiently, the design of the control algorithm requires high-quality mechanical models in terms of accuracy, efficiency, and conciseness. The new modelling method presented here leads to a better compromise between those conflicting criteria. The number of degrees of freedom associated with the deformations is reduced by component mode synthesis, and an interpolation is performed to get an explicit description of the mechanical model in the configuration space. Selecting the number of component modes and the interpolation precision level, the user is able to balance accuracy against efficiency and conciseness. The relevance of the method is illustrated with a few examples.

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