EXPERIMENTAL AND NUMERICAL ANALYSES OF A
MASS-BALANCED FOUR-BAR LINKAGE

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Abstract. This paper deals with the influence of mass-balancing on the elastodynamic performance of closed-loop mechanisms. The long-term goal of the research is the definition of an optimal balancing strategy for parallel spatial manipulators. The present contribution focuses on the experimental investigation of the behavior of an unbalanced four-bar linkage and its mass-balanced version. The main purpose of this study is to verify the validity of the main conclusions retrieved from the preliminary simulations carried out on a simple numerical model. The design of the experimental apparatus is discussed and the results of some tests are presented. The elastodynamic properties of the linkages are evaluated by means of velocity ramp tests, whereas vibrations and forces transmitted to the base are measured considering constant velocity working conditions. Moreover, modal analysis and kineto-elastodynamics simulations are performed on an improved flexible multibody model, in order to obtain a better interpretation of the experimental data.