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Identification and identifiability of inertia parameters of space manipulators**Seyed Yaser Nabavi Chashmi and Seyed Mohammad-Bagher Malaek**
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The long-term sustainability of outer space activities is a great concern for future space operations. Although, activities in space advance our knowledge about the world, however, the space environment is becoming unstable because of a phenomenon, called Kessler-Syndrome. It had been shown by others that at least two space-debris should be deorbited per year to treat this problem. However, active space debris removal is not technically straight forward, so different ideas are proposed in literature during which using space-manipulators is one of the most promising ones. But there are many technical problems in using space-manipulators; one of them is uncertainties of dynamic-model of space-system. To overcome this problem, the system should be identified in flight. In this speech, the results of our researches on the identification of inertia parameters (IPs) of space-manipulators will be presented. First, the concept of matrix-sets as the mathematical tool, developed in our research to facilitate the identification of IPs, will be presented. This tool has been employed to present the generalized-identification formula and to study the effect of uncertain IPs on the accuracy of the identification of IPs of debris. Then the identifiability characteristics of the space-manipulators will be studied and analytical forms of identifiable parameters will be presented. These forms will be used to show that to identify all IPs, distinctively, the robot should be reconfigurable. The effect of relative size of IPs of elements of space-system on the accuracy of identification will be also discussed. The analyses show that accurate off-line measurements of some IPs of manipulator is important as they enhance the convergence speed and help to determine debris and base IPs individually without reconfiguring the robot. However, this assumption yields errors in the identification depending on the relative size of components of robot. So, it should be considered in the design process.

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