

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and
Development (1)

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DYNAMICS RECONFIGURATION AND DIMENSION REDUCTION BASED ON METAMORPHIC
THEORY**Abstract**

Nowadays, space robot attracts more and more attention, the International Space Station completes some difficult missions by Canadarm2. However, during the mission, the robot's dynamical model changes with different topological state, and the dynamical modeling is essential for control, so reconfiguring the model for different state is necessary for mission success. But now, most reconfiguration methods is just for choosing the different established model with the different state, which is just for using but not under the relation of different topology. So we come up with the new dynamical reconfiguration method for rigid multibody systems. Compared with the traditional methods, the new method is based on the relation of different topology, and we don't need to know all the kinds of configurations the robot will be before the mission, but the robot can reconfigure on orbit by identifying the structure, this would make the mission more convenient and robustly. What's more, the space robot would achieve different missions and even emergency not planned before. For finding the relation among the different topological states for dynamical reconfiguration, firstly, we make the research on metamorphic theory which uses adjacency matrix and metamorphic matrix to describe nature of the change process by Matrix theory for getting the relation between two different topological states. After that secondly, we find the basic parameter matrices for dynamical model and the relation among the different states. then, by combining the metamorphic matrices with dynamical model, we get the relation of dynamical parameter matrices among different topological structures, and describe it on Matrix theory. Finally, a dual arms platform is numerical simulated and we compared the results with Adams. The method can describe the nature of parameter matrices' changing process, and it's easy to compute. Comparing with the old methods, it would reconfigure the dynamical model under the whole kinds of topological state.