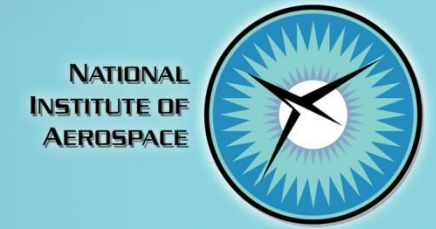


Flexible Multi- Body Dynamic Analysis of a Robotic Manipulator-Based Capture System for the Asteroid Redirect Mission (ARM)



SUMMARY

The primary objective of this work is the dynamic analyses of the Tendon-Actuated Lightweight In-Space Manipulator (TALISMAN) which entails structural dynamics, multi-body dynamics and flexible multi-body dynamics modeling and simulation of robotic systems, associated space vehicles and operations. The dynamic analysis is in the critical path of TALISMAN technology development for utilization in the Asteroid Redirect Mission (ARM) and for potential application to Satellite Servicing Missions (SSM). In addition, modeling work supports control design, and the testing of space operations.

CURRENT WORK

- Model development of TALISMAN designs that are governed by geometric nonlinearities of the total system and nonlinear cable members in the flexible multi-body system.
- Dynamic simulation of ARM sequences of nominal space vehicles using TALISMAN capture system.
- Determination of dynamic response characteristics, failure modes, and optimal kinematic manipulator poses that minimize structural loads while performing desired mission operations.

METHODOLOGY



Figure 1: Graphic of ongoing Technology development TALISMAN shown in proposed Satellite Servicing Mission (SSM) (Image Credit: NASA)

A four-link TALISMAN configuration designed to match the Shuttle Remote Manipulator System (SRMS) performance is used for the component model development and as the baseline configuration in the analyses. System design parameters and kinematics are varied to represent system states that are expected to occur during mission operations, as depicted in in Fig.1.

TALISMAN component models are also integrated into a vehicle dynamics model (Fig.2.) of a proposed ARM spacecraft performing ARM concept 'B' (Fig.3.). The vehicle dynamics model is used to calculate the dynamic requirements imposed on the TALISMAN robotic capture system during the mission.

Engineering Interests:

Linear and nonlinear flexible multi- body dynamics,
Vehicle dynamics, Dynamics and control, UAV's,
Robotic systems, Conceptual design and development

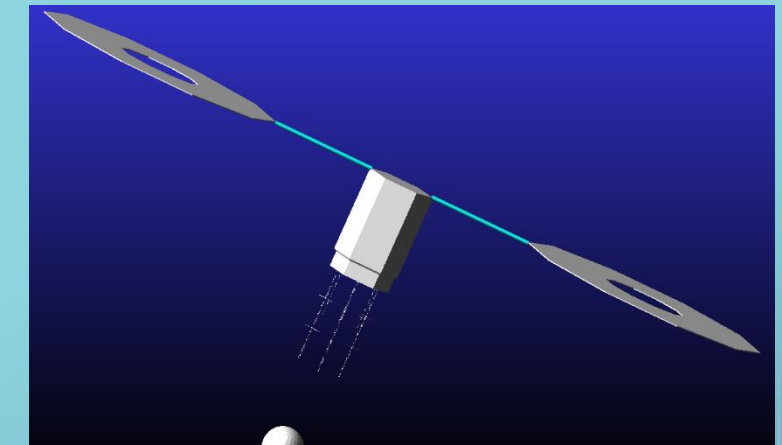


Figure 2: Vehicle Dynamics Model of nominal Space Vehicle using TALISMAN Capture System

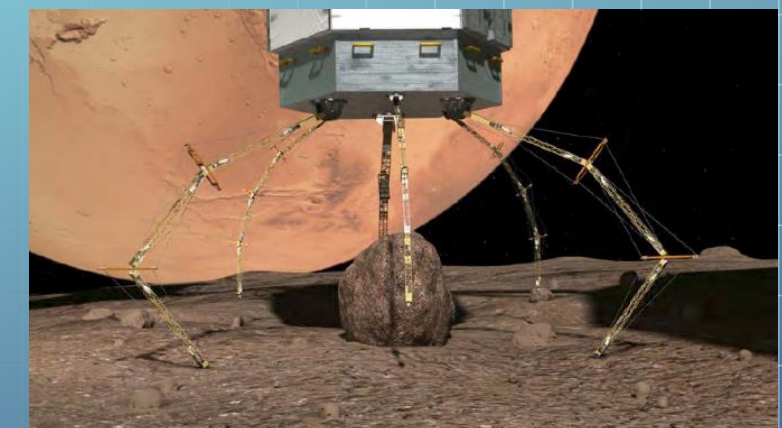


Figure 3: Graphic of TALISMAN Capture System performing in ARM Concept 'B' (Image Credit: NASA)

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