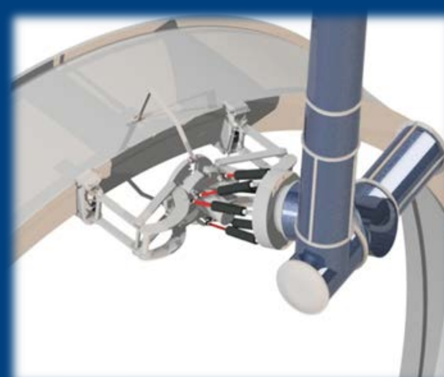
Predator

Short Project Presentation

ESTEC

24 October 2017



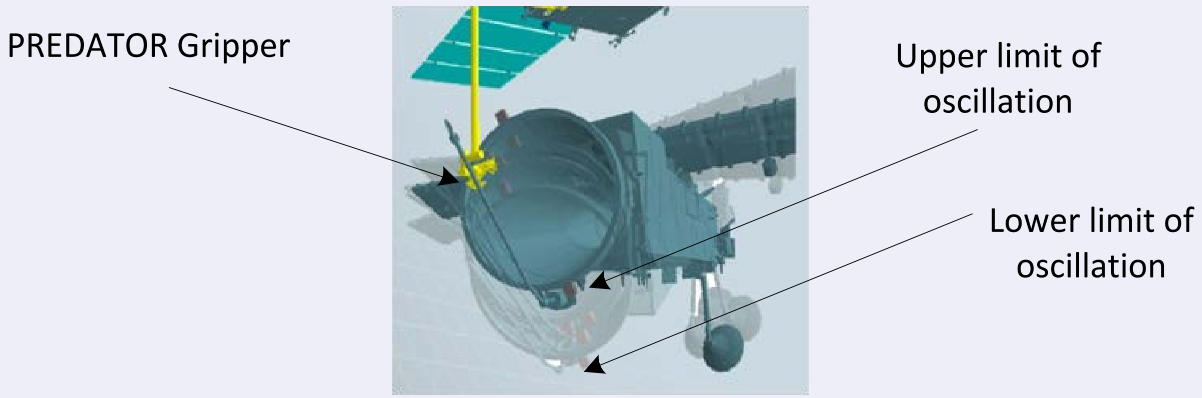
Contents of the Presentation

LAR Motion Study and Videos

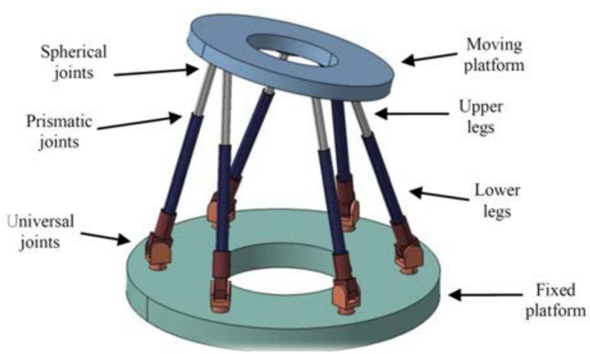
Stewart Platform study for Gripper isolation from DLR robot and Videos

Hellenic Technology of Robotics

LAR Motion Study : What is the expected range of motion and the timing?



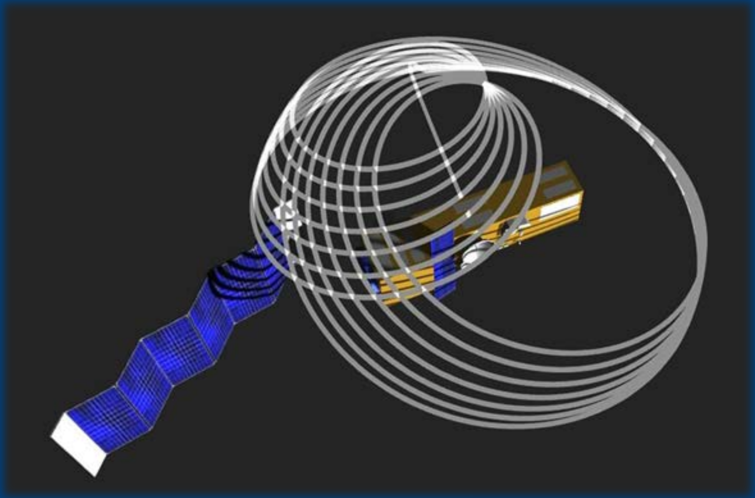
Stewart Platform : Can it be used to isolate the gripper from the DLR arm?

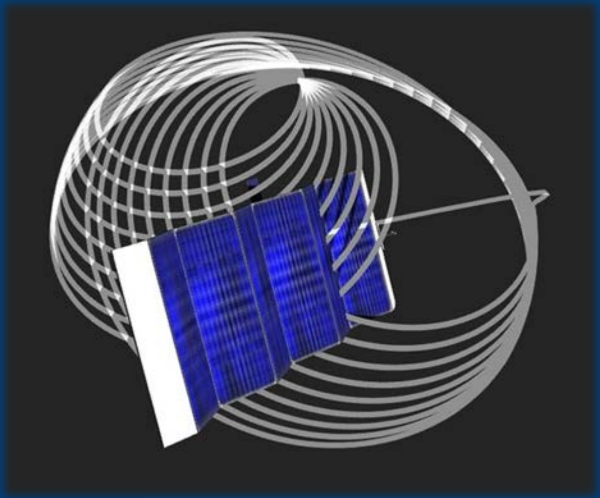


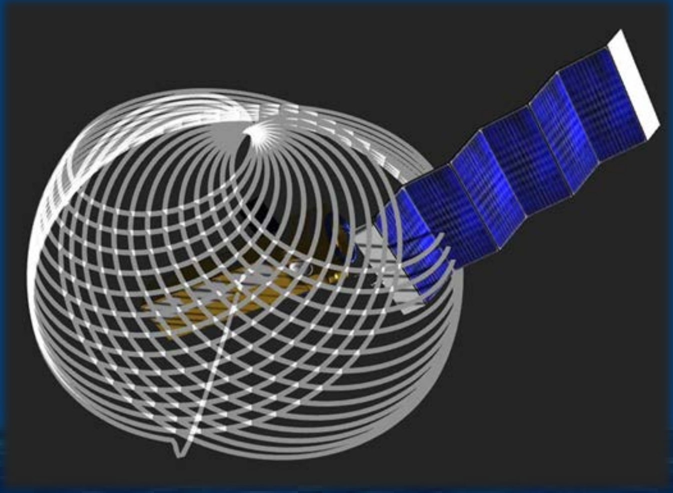
LAR Motion Study Examples

An Impossible to Catch Scenario Example 1/2

During this simulation the satellite (ENVISAT) is moving in a way that does not allow the chaser to approach it safely.







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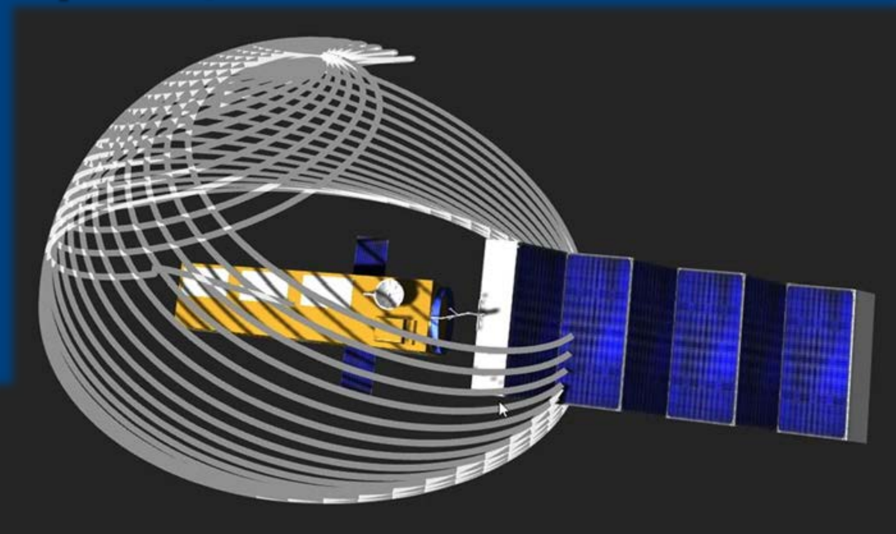
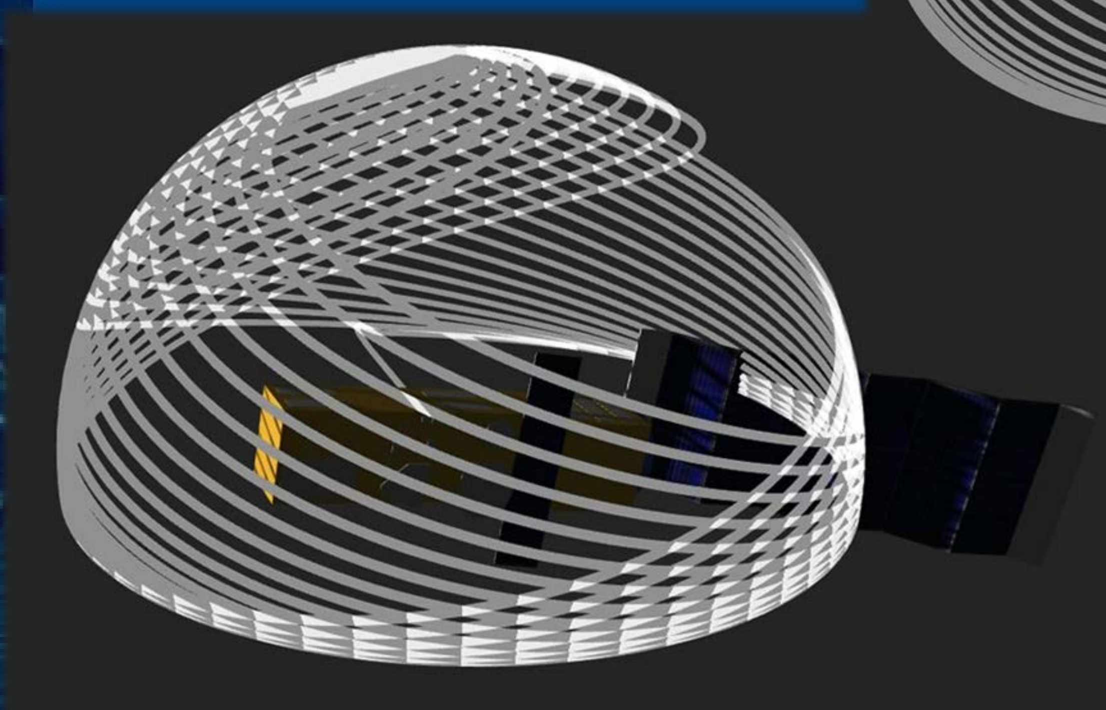
LAR Motion Study

Example 2/2

This scenario is similar to the scenario 1 presented by B1 Phase Final Report page 9-41 and it is clear that the chaser cannot approach safely the target satellite (ENVISAT)





A whole hemisphere is covered by the marker on z-axis of ENVISAT body frame

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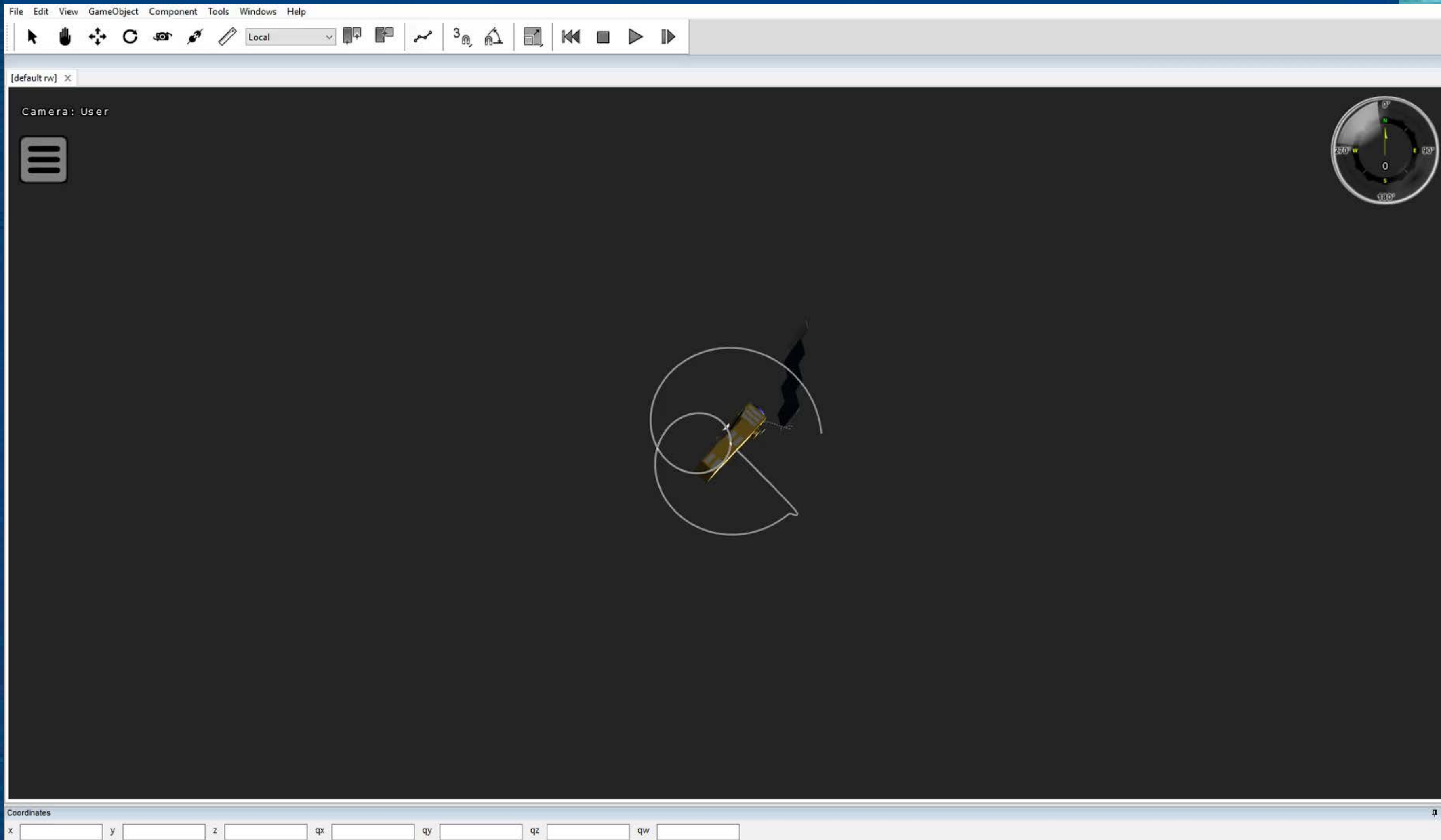

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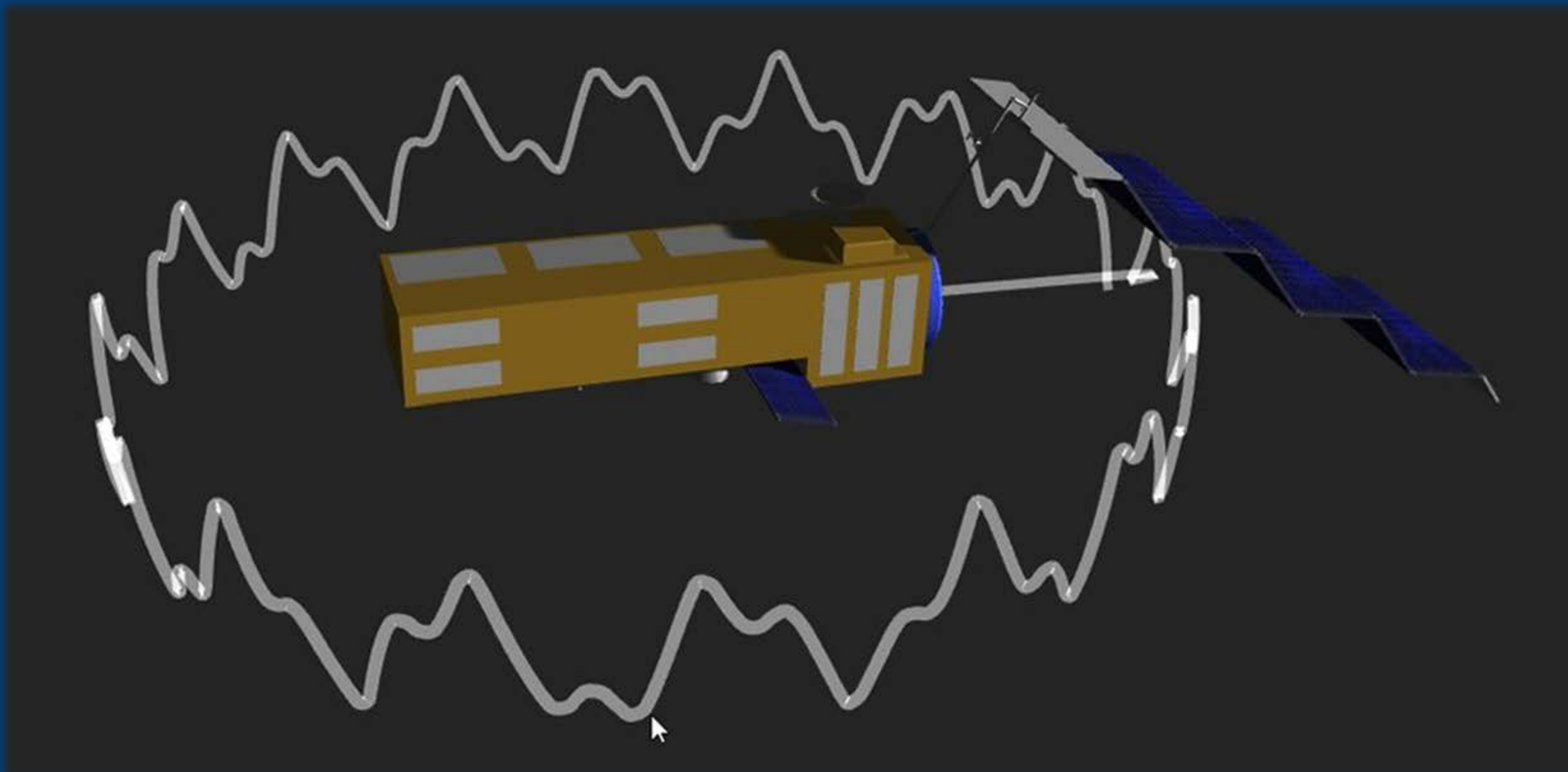
LAR Motion Study

A Possible to Catch Scenario 1 / 4



Overall view of the tumbling motion (Scenario 3 of B1 phase Final Report)

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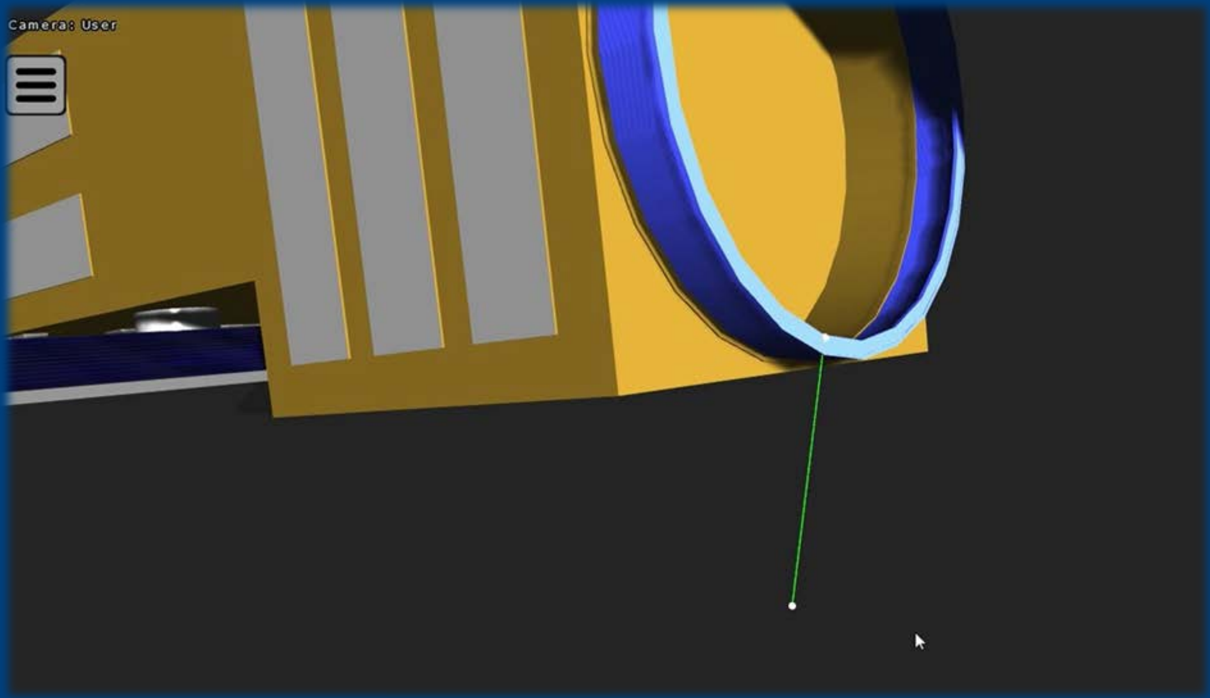
LAR Motion Study

Simulation 2/4



A slow oscillation of a very small amplitude is observed, if the spin (z) axis of the chaser is synchronized with ENVISAT

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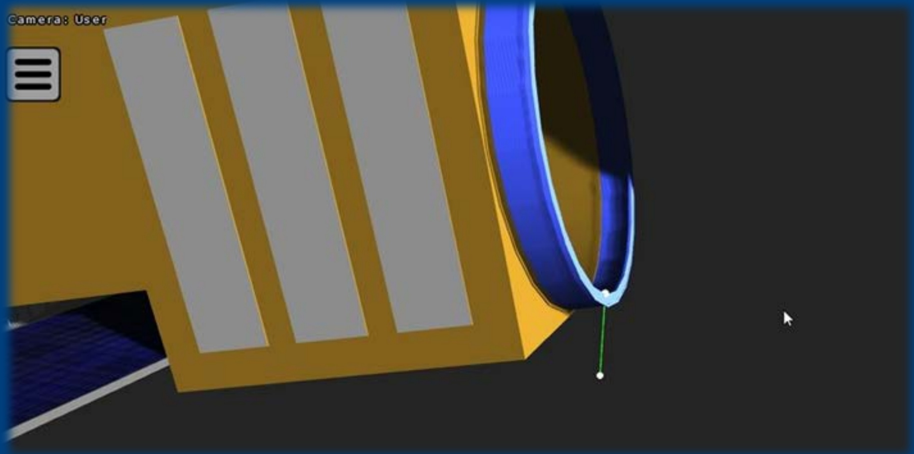
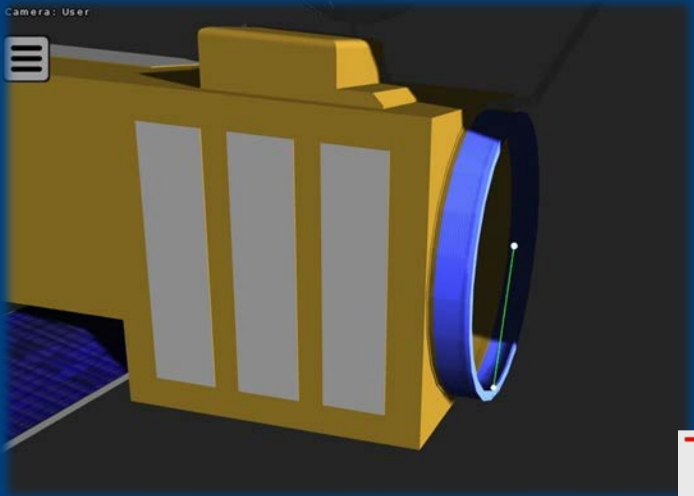
A Possible to Catch Scenario 3/4

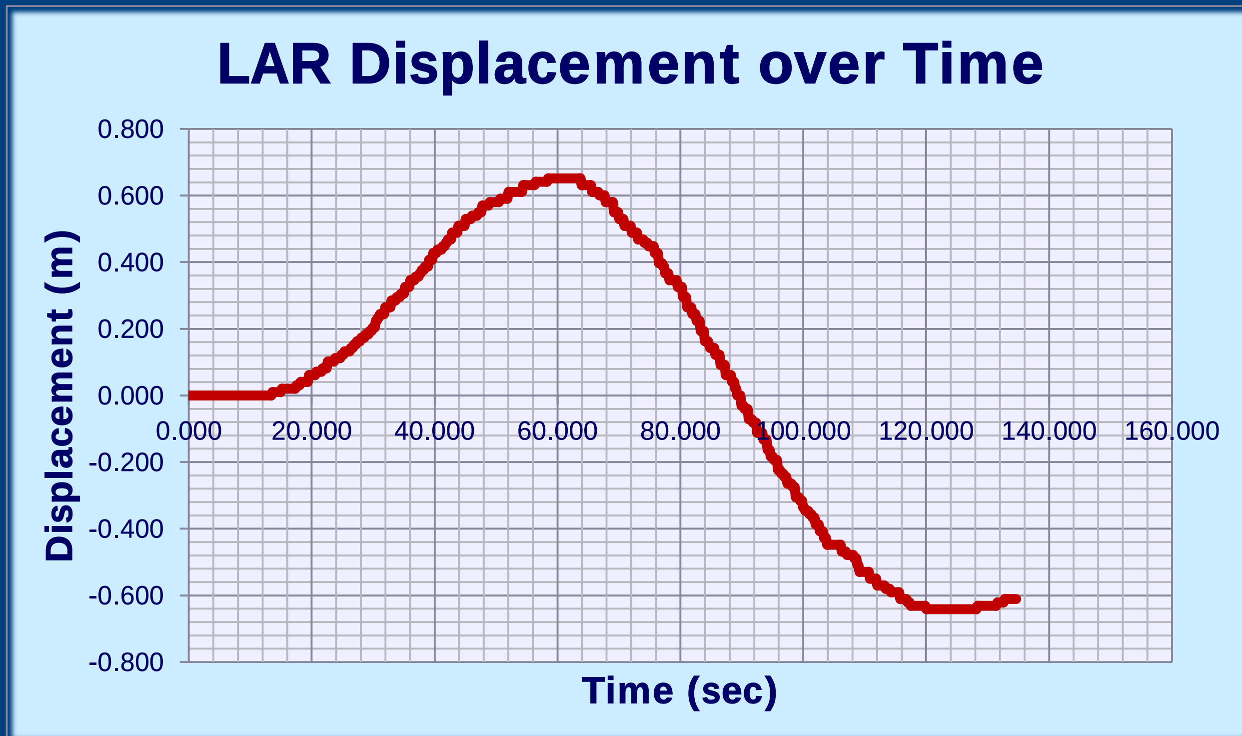




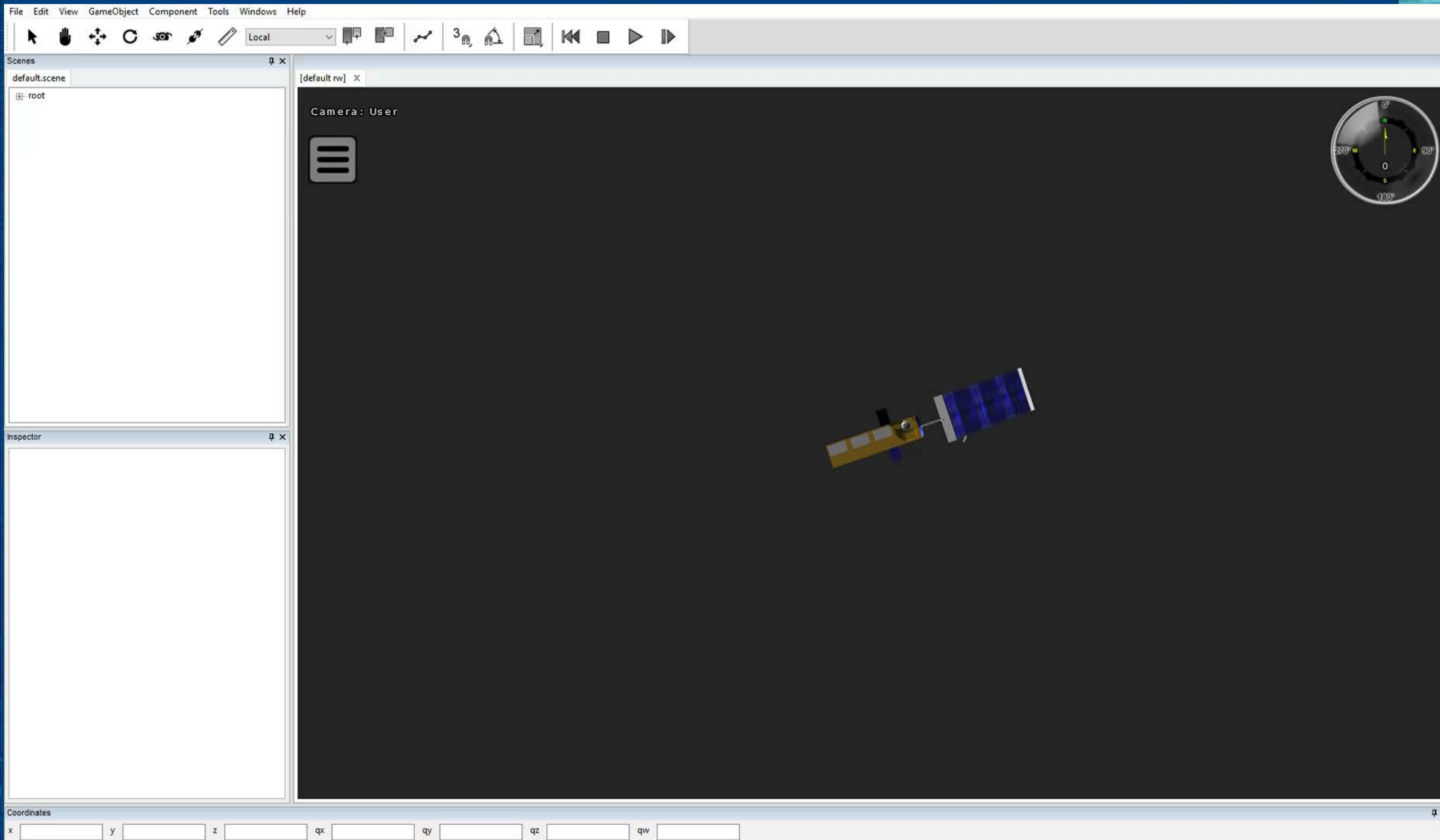
Two positions of slow oscillation.
The displacement is sufficient for a safe grab.

LAR Motion Study

Simulation 4/4



For the time interval (00:50 - 03:02) of this simulation, there are time periods of several seconds in which the LAR is idle, or it displaces itself for a few cm (minimum and maximum of the graph).



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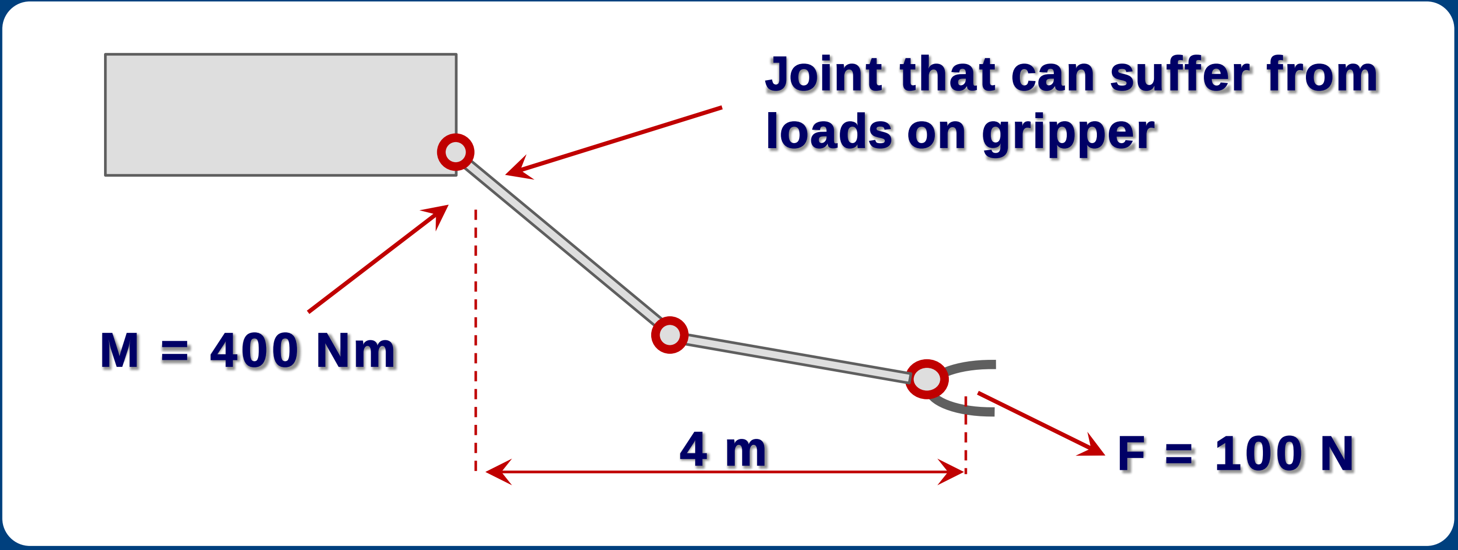
Stewart Platform study for Gripper isolation

The Problem

DLR ARM

Very long structure with substantial moment of inertia and limited max torque on joints



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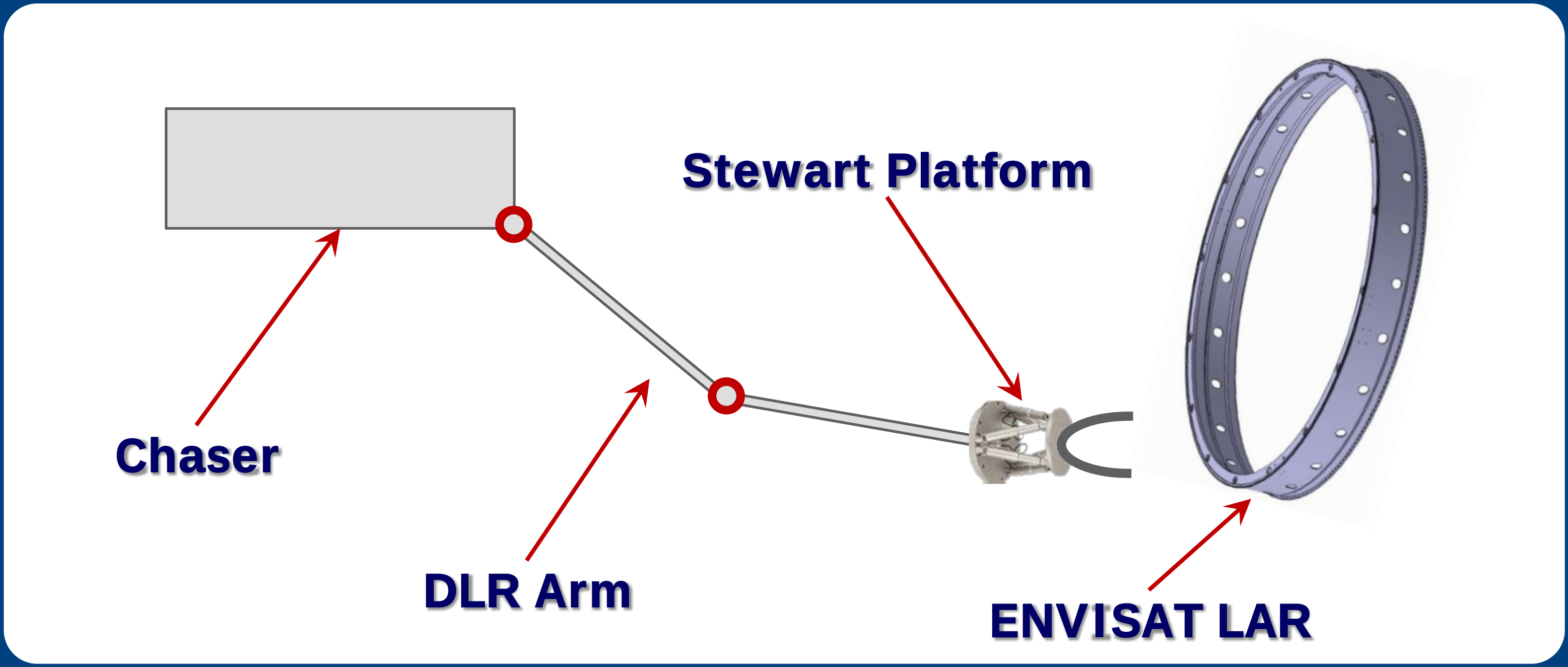
Stewart Platform

The Solution

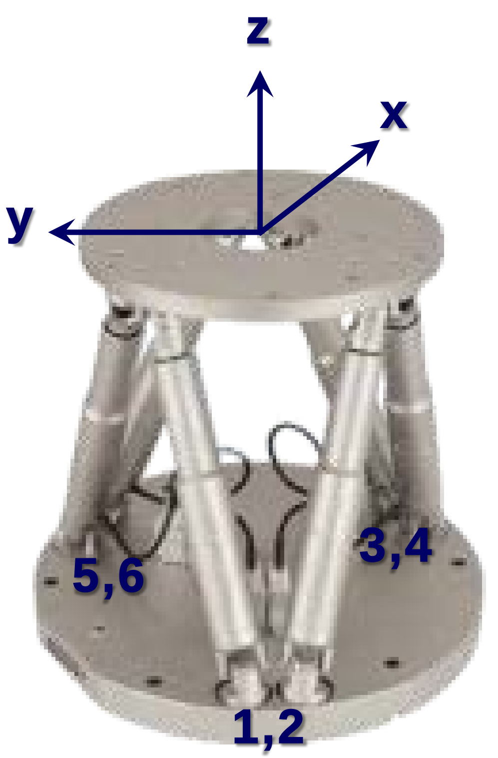
Stewart Platform
A variable impedance 6-DOF wrist



Stewart Platform

Can be driven either with Direct Kinematics

Direct Kinematics



$\Rightarrow$

$$\begin{vmatrix} F_1 & F_4 \\ F_2 & F_5 \\ F_3 & F_6 \end{vmatrix}$$

Given Forces along legs 1,...,6

$\Rightarrow$

$$\begin{matrix} F_x & M_x \\ F_y & M_y \\ F_z & M_z \end{matrix}$$

Produced Forces and Torques along x, y, z axes

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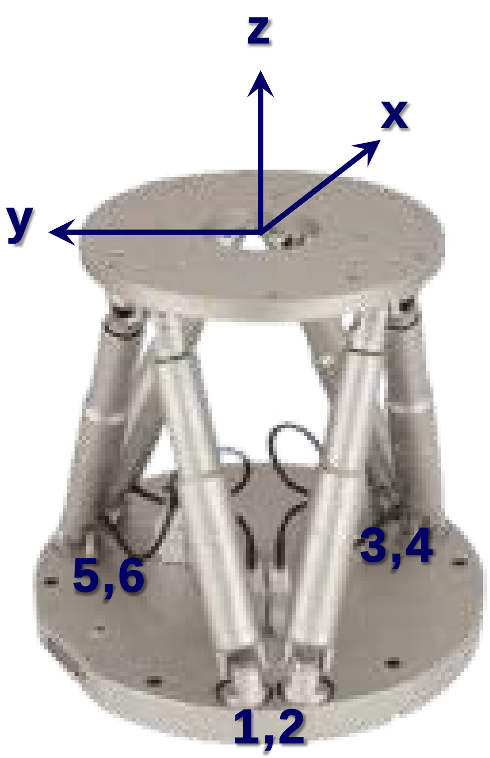
Stewart Platform

Or with Inverse Kinematics

Inverse Kinematics



$\Rightarrow$

$$\begin{matrix} F_x & M_x \\ F_y & M_y \\ F_z & M_z \end{matrix}$$

Given Forces and Torques along x, y, z axes

$\Rightarrow$

$$\begin{vmatrix} F_1 & F_4 \\ F_2 & F_5 \\ F_3 & F_6 \end{vmatrix}$$

Produced Forces along legs 1,...,6

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Stewart Platform

Pre-prototype built for concept verification and control loop tuning

Specifications :
Workspace : 100 x 100 x 100 mm, 40° rotation
Speed : 30mm/sec

Max force: 30N, all directions
Max torque : 2 Nm, all directions

Mass: 7 kg

Power: 18W

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Stewart Platform

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End of Presentation

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