SPHERICAL PARALLEL ROBOT

An Educational Mechanism for Manufacturing Machine Dynamic Lab

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Sponsor: Manufacturing Program

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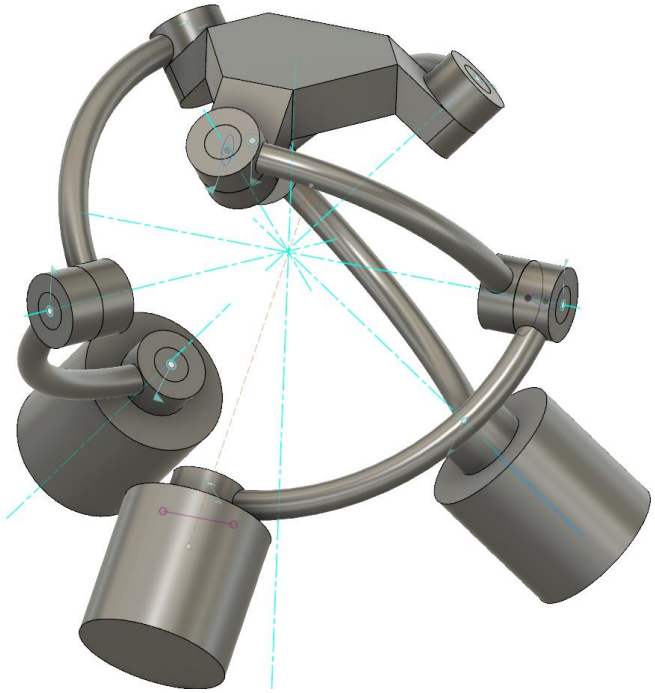
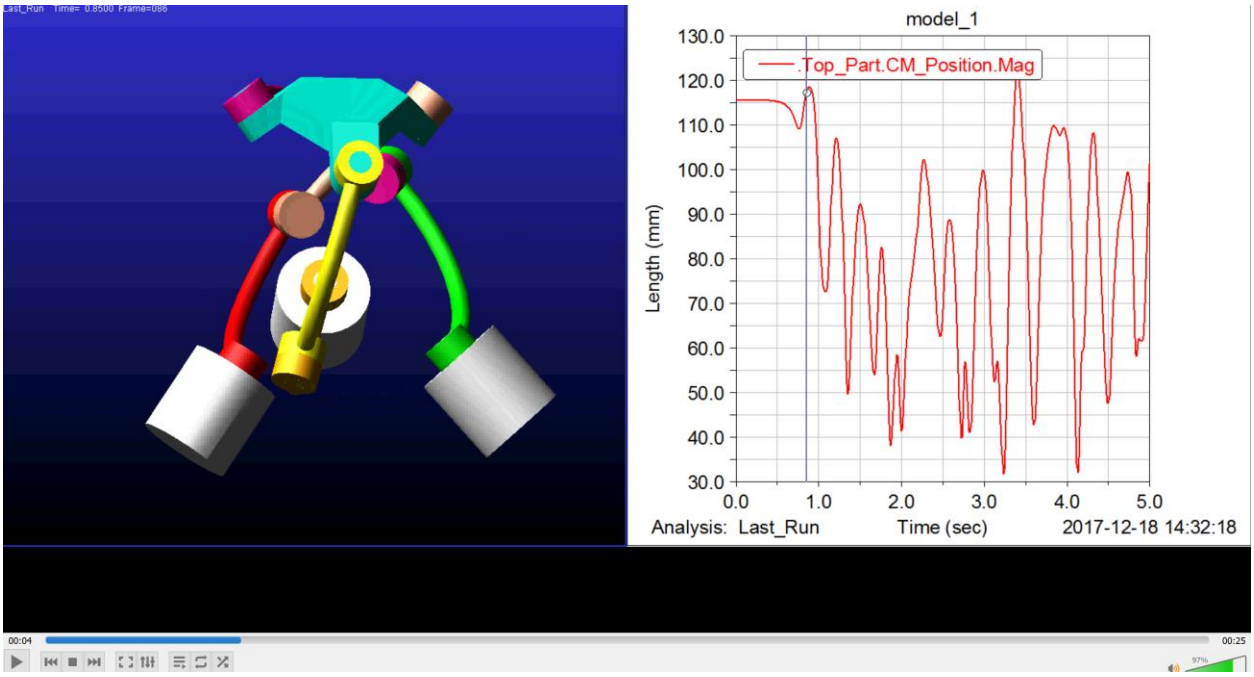
Video Description of the project

Introduction: Parallel manipulators consist of separate serial chains connecting the fixed base to the moving platform. Typically, a parallel mechanism is said to be symmetrical if one actuator controls every limb and the location and the number of actuated joints in all the limbs are the same. The mechanism can produce a translation or spherical motion to a platform. The parallel robots can be equipped with hydraulic or pneumatic actuators. They have a robust construction and can move bodies of heavy masses and dimensions with high speeds. Compared with the serial robots, parallel mechanisms have some special characteristics: greater structural rigidity, higher orientation accuracy, functional stability, larger dynamic charge capacity and suitable position of the actuating systems.



A Spherical Parallel Mechanism 3D Model

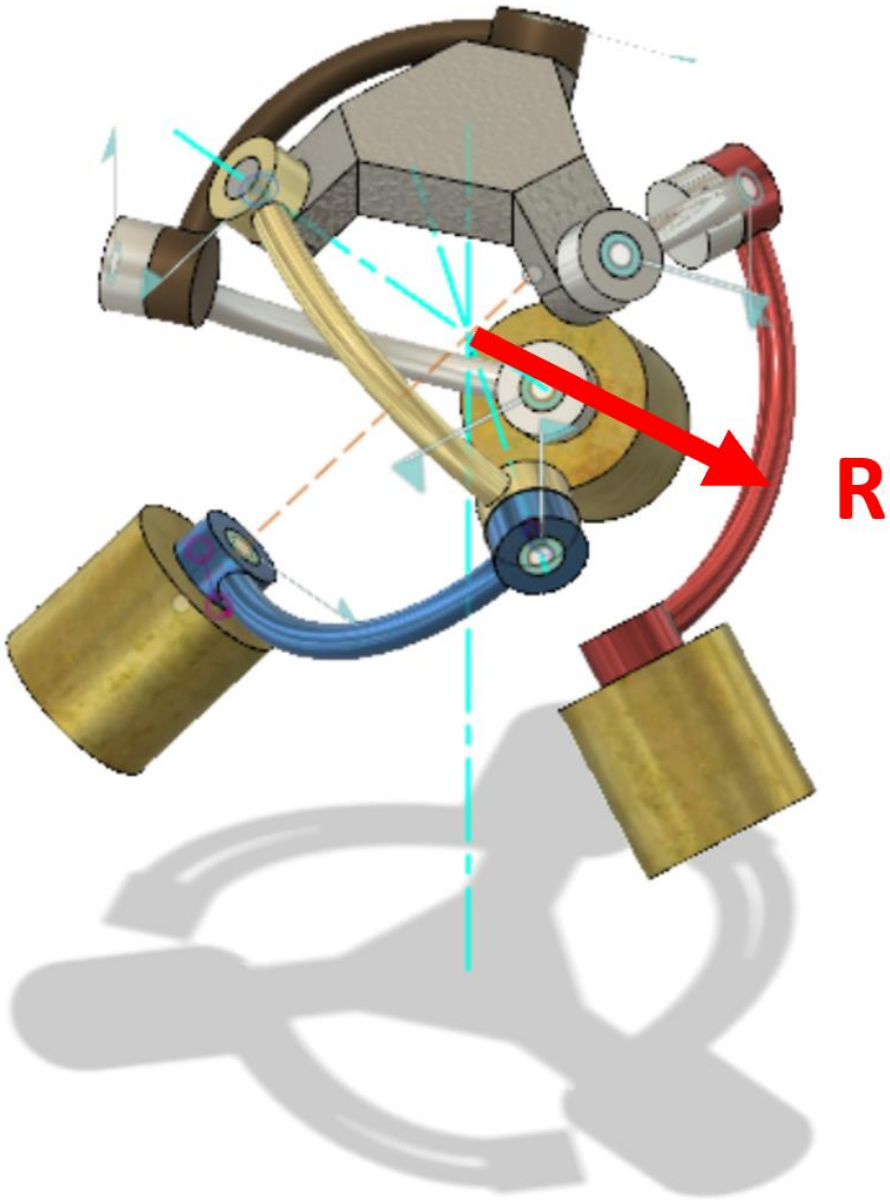
I have uploaded an animation of this Mechanism on YouTube. Click play to watch it on YouTube:



This mechanism has a plethora of applications in Bio Medical Engineering, Military, Industrial Automation, fast pick-and place operations, Precision machinery, High precision surface laser scanning, Orientation of Antenna, Orientation of solar panels, Orientation of high speed cameras, tracking of high speed objects, flight simulator, Micro-surgery, Remote Surgery, many applications in nuclear power plants, and manifold of other applications.

Brief Project Description:

The manufacturing machine dynamic lab needs this robot, for educational purpose for the course MANU 265 (Machine Dynamics), and conducting research on the application of this robot. The appropriate size of the robot for these purposes is R= 25 CM (this is the radius of the spherical robot).



The material should be metal to avoid any deformation during the performance. All the joints must be high performance bearings.

The picture below shows a fast prototype of a version of this mechanism, in small size.

After building the mechanism, your main task is the programing of the 3 motors, so the center of the robot platform follows the command path/trajectory of the platform.

Expected Outcomes:

Fully functional mechanism. The final mechanism must be made out of metal, not 3D printing PLA or plastic. The code to run the robot, similar to performance of a CNC, is an essential part of the deliverable for this project.

Resources Available from Customer:

I am available to meet with students bi-weekly to answer any questions and provide design feedback. I also provide essential information regarding the dynamics of this mechanism, and the resources to study, and understand the dynamic of this mechanism. The Manufacturing program also gives you **$1250** in addition of the department budget for each project **($750**). You can also have access to tools and sensors in Machine Dynamics lab; for example, motion or accelerometer sensors to test either the initial prototype or the final product. You can also get the motors and the control board *(shown in above picture*) to start with building a small 3D printed prototype to proceed better with the actual design.

Contact for more details: If you have any question or concerns regarding this project, you can send me an email directly at: mpanah@mail.ubc.ca or I am available for a ZOOM meeting to discuss the project and answer your questions.

Ahmad