Mechanics

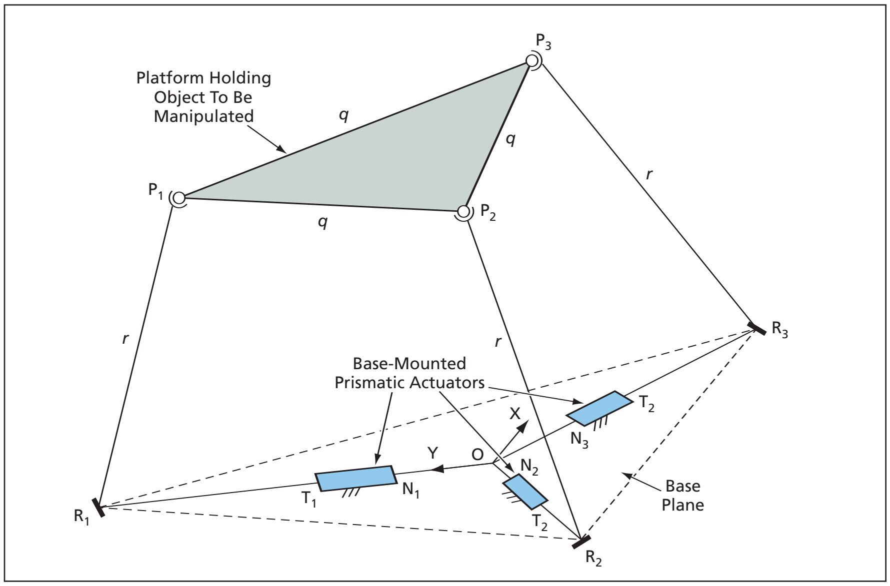
Tilt/Tip/Piston Manipulator With Base-Mounted Actuators

The geometry and kinematics of this manipulator would afford advantages for some applications.

Goddard Space Flight Center, Greenbelt, Maryland

A proposed three-degree-of-freedom (tilt/tip/piston) manipulator, suitable for aligning an optical or mechanical component, would offer several advantages over prior such manipulators:

- Unlike in some other manipulators, no actuator would support the weight of another actuator: All of the actuators would be mounted on a base. Hence, there would be less manipulated weight.
- The basic geometry of the manipulator would afford mechanical advantage: that is, actuator motions would be larger than the motions they produce in the manipulated object. Mechanical advantage inherently increases the accuracy and resolution of manipulation.
- Unlike in some other manipulators, it would not be necessary to route power and/or data lines through manipulator joints.



Lengths of Links R_1T_1, R_2T_2, and R_3T_3 are varied to adjust the piston, tilt, and tip coordinates of the platform.

The proposed manipulator (see figure) would include three prismatic actuators (T_1N_1, T_2N_2, and T_3N_3) mounted on the base and operating in the same plane. Examples of suitable prismatic actuators include lead-screw mechanisms, linear hydraulic motors, piezoelectric linear drives, inchworm-movement linear stepping motors, and linear flexure drives. The actuators would control the lengths of links R_1T_1, R_2T_2, and R_3T_3.

Three spherical joints (P_1, P_2, and P_3) would be located at the corners of an equilateral triangle of side length q on the platform holding the object to be manipulated. Three inextensible limbs (R_1P_1, R_2P_2, and R_3P_3) having length r would connect the spherical joints on the platform to revolute joints (R_1, R_2, and R_3) at the ends of the actuator-controlled links R_1T_1, R_2T_2, and R_3T_3. By varying the lengths of these links, one could control the tilt, tip, and piston coordinates of the platform. Closed-form equations for direct or forward kinematics of the manipulator (given the lengths of the variable links, find the tilt, tip, and piston coordinates) have been derived. The equations of inverse kinematics (find the variable link lengths needed to obtain the desired tilt, tip, and piston coordinates) have also been derived.

This work was done by Farhad Tahmasebi of **Goddard Space Flight Center**. *Further information is contained in a TSP (see page 1).*
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Measurement of Model Noise in a Hard-Wall Wind Tunnel

Spurious noise is suppressed in processing of digitized microphone outputs.

Ames Research Center, Moffett Field, California

Identification, analysis, and control of fluid-mechanically-generated sound from models of aircraft and automobiles in special low-noise, semi-anechoic wind tunnels are an important research endeavor. Such studies can also be done in aerodynamic wind tunnels that have hard walls if phased microphone arrays are used to focus on the noise-source regions and reject unwanted reflections or background noise. Although it may be difficult to simulate the total fly-over or drive-by noise in a closed wind tunnel, individual noise sources can be isolated and analyzed.

An acoustic and aerodynamic study was made of a 7-percent-scale aircraft model in a NASA Ames 7-by-10-ft (about 2-by-3-m) wind tunnel for the purpose of identifying and attenuating airframe noise sources. Simulated landing, takeoff, and approach configurations were evaluated at Mach 0.26. Using a phased microphone array mounted in the ceiling over the inverted model, various