The variable terrain tilt platform (VTTP) is a means of providing simulated terrain for mobility testing of engineering models of the Mars Exploration Rovers. The VTTP could also be used for testing the ability of other robotic land vehicles (and small vehicles in general) to move across terrain under diverse conditions of slope and surface texture, and in the presence of obstacles of various sizes and shapes.

The VTTP consists mostly of a 16-ft-(4.88-m)-square tilt table. The tilt can be adjusted to any angle between 0° (horizontal) and 25°. The test surface of the table can be left bare; can be covered with hard, high-friction material; or can be covered with sand, gravel, and/or other ground-simulating material or combination of materials to a thickness of as much as 6 in. (≈15 cm).

This work was done by Stanley E. Woodard, Qamar A. Shams, and Robert L. Fox of Langley Research Center and Virginia and Bryant D. Taylor of Swales Aerospace Corporation. Further information is contained in a TSP (see page 1).

LAR-16908
Models of rocks, trenches, and other obstacles can be placed on the simulated terrain. For example, for one of the Mars-Rover tests, a high-friction mat was attached to the platform, then a 6-in.- (≈15 cm) deep layer of dry, loose beach sand was deposited on the mat. The choice of these two driving surface materials was meant to bound the range of variability of terrain that the rover was expected to encounter on the Martian surface. At each of the different angles at which tests were performed, for some of the tests, rocklike concrete obstacles ranging in height from 10 to 25 cm were placed in the path of the rover (see figure).

The development of the VTTP was accompanied by development of a methodology of testing to characterize the performance and modes of failure of a vehicle under test. In addition to variations in slope, ground material, and obstacles, testing typically includes driving up-slope, down-slope, cross-slope, and at intermediate angles relative to slope. Testing includes recording of drive-motor currents, wheel speeds, articulation of suspension mechanisms, and the actual path of the vehicle over the simulated terrain. The collected data can be used to compute curves that summarize torque, speed, power-demand, and slip characteristics of wheels during the traverse.

This work was done by Randel Lindemann of Caltech for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

NPO-42522

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Interferometer for Low-Uncertainty Vector Metrology

Accuracy is increased; time and cost are reduced.

Goddard Space Flight Center, Greenbelt, Maryland

The figure is a simplified schematic diagram of a tilt-sensing unequal-path interferometer set up to measure the orientation of the normal vector of one surface of a cube mounted on a structure under test. This interferometer has been named a “theoferometer” to express both its interferometric nature and the intention to use it instead of an autocollimating theodolite.

The theoferometer optics are mounted on a plate, which is in turn mounted on orthogonal air bearings for near-360° rotation in azimuth and elevation. Rough alignment of the theoferometer to the test cube is done by hand, with fine position adjustment provided by a tangent arm drive using linear inchwormlike motors.

In the operation of the theoferometer, the interference pattern formed by the collimated laser beams reflected from the two cubes is focused onto a

In this interferometer, the interference pattern formed by the laser beams from the cubes is imaged onto the CCD. This pattern would depend on the angular misalignment between the cubes and would be analyzed to determine the misalignment.