



Mechanics/Machinery

⚙️ Mechanism for Particle Transport and Size Sorting via Low-Frequency Vibrations

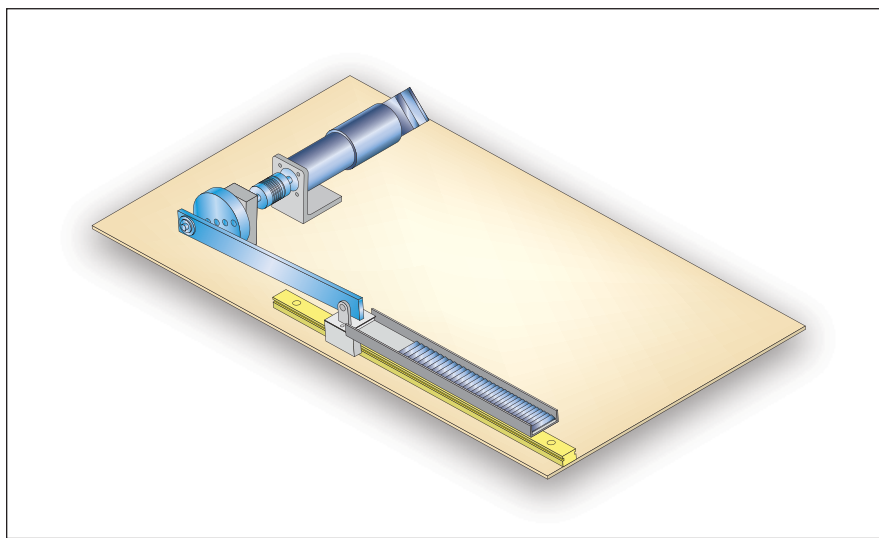
This technology would be useful for applications requiring sample handling.

NASA's Jet Propulsion Laboratory, Pasadena, California

There is a need for effective sample handling tools to deliver and sort particles for analytical instruments that are planned for use in future NASA missions. Specifically, a need exists for a compact mechanism that allows transporting and sieving particle sizes of powdered cuttings and soil grains that may be acquired by sampling tools such as a robotic scoop or drill. The required tool needs to be low mass and compact to operate from such platforms as a lander or rover. This technology also would be applicable to sample handling when transporting samples to analyzers and sorting particles by size.

A metal bar or plate with a linear array of asymmetric grooves has been designed to be shaken at low frequency by a voice coil, or linear actuator, mechanism which induces the particles to jump from one groove to the next. Larger particles with diameters greater than the groove depth were shown to move quicker, while particles with a diameter that is less than the groove depth were found to move slower, thus creating a sorting by size. Using this asymmetry in particle motion with particle size, it is shown that both the movement of unconsolidated particles along the slide provided both transportation and sorting mechanisms.

The initial motion of the plate was created by a rotary motor linked to create symmetric vibrations. The figure shows a graphic illustration of this system. The rotary motion can be used to sample unconsolidated material from a platform. A ro-



A Schematic View of the System using a rotary motor and a slide with asymmetric grooves.

tary motor causes linear oscillatory motion in the rod through a linkage, and causes particles in the grooves to move to higher-level grooves by being thrown from a lower groove. The linear actuation also could be developed with a voice coil actuator or any other linear motor. The use of asymmetric teeth increases the likelihood of a forward transfer of particles, and in each jump, the particles climb the toothlike steps. Introducing elliptical oscillations increases the efficiency of transfer by giving the sample movement vector normal to the slide axis.

An option to this design includes sieves to allow gauging of particle di-

mension. A distribution of particles is transported to the end of the groove rod. When particles enter a sieve with smaller holes, the excitation shakes them through the sieve. The excitation frequency is then increased, and the differentiated sample is then moved to the next larger size sieve where the process is repeated until all particles are sieved.

This work was done by Stewart Sherrit, James S. Scott, Yoseph Bar-Cohen, Mircea Badescu, and Xiaoqi Bao of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-46334

⚙️ Compact, Lightweight Electromagnetic Pump for Liquid Metal

Overlapping thermal and magnetic issues are considered in this design increase efficiency.

Marshall Space Flight Center, Alabama

A proposed direct-current electromagnetic pump for circulating a molten alkali metal alloy would be smaller and lighter and would demand less input power, relative to currently available

pumps of this type. (Molten alkali metals are used as heat-transfer fluids in high-temperature stages of some nuclear reactors.) The principle of operation of this or any such pump involves exploita-

tion of the electrical conductivity of the molten metal: An electric current is made to pass through the liquid metal along an axis perpendicular to the longitudinal axis of the flow channel, and a