flectors. The radiator blades are oriented at an angle chosen to prevent infrared loading from the Moon limb at the intended orbital altitude and attitude. The reflectors are shaped and oriented to position their foci outside the radiator surfaces. There are six radiator-blade/reflector pairs — two pairs for each stage of cooling. The radiator blades and reflectors are coated on their front and back surfaces with materials having various infrared emissivities, infrared reflectivities, and solar reflectivities so as to maximize infrared radiation to cold outer space and minimize inadvertent solar heating. The radiator blades and reflectors are held in place by a lightweight support structure, the components of which are designed to satisfy a complex combination of thermal and mechanical requirements.

This work was done by Jose I. Rodriguez of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).
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GVIPS Models and Software

Two reports discuss, respectively, (1) the generalized viscoplasticity with potential structure (GVIPS) class of mathematical models and (2) the Constitutive Material Parameter Estimator (COMPARE) computer program. GVIPS models are constructed within a thermodynamics- and potential-based theoretical framework, wherein one uses internal state variables and derives constitutive equations for both the reversible (elastic) and the irreversible (viscoplastic) behaviors of materials. Because of the underlying potential structure, GVIPS models not only capture a variety of material behaviors but also are very computationally efficient.

COMPARE comprises (1) an analysis core and (2) a C++-language subprogram that implements a Windows-based graphical user interface (GUI) for controlling the core. The GUI relieves the user of the sometimes tedious task of preparing data for the analysis core, freeing the user to concentrate on the task of fitting experimental data and ultimately obtaining a set of material parameters. The analysis core consists of three modules: one for GVIPS material models, an analysis module containing a specialized finite-element solution algorithm, and an optimization module. COMPARE solves the problem of finding GVIPS material parameters in the manner of a design-optimization problem in which the parameters are the design variables.

This work was done by Steven M. Arnold of Glenn Research Center and Atef Gendy, Atef F. Saleeb, John Mark, and Thomas E. Wilt of the University of Akron. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17999-1/8000-1

Stowable Energy-Absorbing Rocker-Bogie Suspensions

A report discusses the design of the rocker-bogie suspensions of the Mars Exploration Rover vehicles, which were landed on Mars in January 2004. Going beyond the basic requirements regarding mobility on uneven terrain, the design had to satisfy requirements (1) to enable each suspension to contort so that the rover could be stowed within limited space in a tetrahedral lander prior to deployment and (2) that the suspension be able to absorb appreciable impact loads, with limited deflection, during egress from the lander and traversal of terrain.

For stowability, six joints (three on the right, three on the left) were added to the basic rocker-bogie mechanism. One of the joints on each side was a yoke-and-clevis joint at the suspension/differential interface, one was a motorized twist joint in the forward portion of the rocker, and one was a linear joint created by modifying a fixed-length bogie member into a telescoping member. For absorption of impact, the structural members were in the form of box beams made by electron-beam welding of machined, thin-walled, C-channel, titanium components. The box beams were very lightweight and could withstand high bending and torsional loads.

This work was done by Brian Harrington and Christopher Voorhees of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.
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