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the stereo disparity error were obtained by use of reflective metrological targets taped to corners of bricks placed at known positions relative to the cameras. For the particular 1,024-by-768-pixel cameras of the system analyzed, the standard deviation of the down-range disparity error was found to be 0.32 pixel.

This work was done by Won Kim, Adnan Ansar, Robert Steele, and Robert Steinke of Caltech for NASA's Jet Propulsion Laboratory. For further information, contact iaoffice@jpl.nasa.gov
NPO-42487

Estimating the Inertia Matrix of a Spacecraft

A paper presents a method of utilizing some flight data, aboard a spacecraft that includes reaction wheels for attitude control, to estimate the inertia matrix of the spacecraft. The required data are digitized samples of (1) the spacecraft attitude in an inertial reference frame as measured, for example, by use of a star tracker and (2) speeds of rotation of the reaction wheels, the moments of inertia of which are deemed to be known.

Starting from the classical equations for conservation of angular momentum of a rigid body, the inertia-matrix-estimation problem is formulated as a constrained least-squares minimization problem with explicit bounds on the inertia matrix incorporated as linear matrix inequalities. The explicit bounds reflect physical bounds on the inertia matrix and reduce the volume of data that must be processed to obtain a solution. The resulting minimization problem is a semidefinite optimization problem that can be solved efficiently, with guaranteed convergence to the global optimum, by use of readily available algorithms. In a test case involving a model attitude platform rotating on an air bearing, it is shown that, relative to a prior method, the present method produces better estimates from few data.

This work was done by Behçet Açikmeşe, Jason Keim, and Joel Shields of Caltech for NASA's Jet Propulsion Laboratory.

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-43631.

Spatial Coverage Planning for Exploration Robots

A report discusses an algorithm for an onboard planning and execution technology to support the exploration and characterization of geological features by autonomous rovers. A rover that is capable of deciding which observations are more important relieves the engineering team from much of the burden of attempting to make accurate predictions of what the available rover resources will be in the future. Instead, the science and engineering teams can uplink a set of observation requests that may potentially oversubscribe resources and let the rover use observation priorities and its current assessment of available resources to make decisions about which observations to perform and when to perform them.

The algorithm gives the rover the ability to model spatial coverage quality based on data from different scientific instruments, to assess the impact of terrain on coverage quality, to incorporate user-defined priorities among subregions of the terrain to be covered, and to update coverage quality rankings of observations when terrain knowledge changes. When the rover is exploring large geographical features such as craters, channels, or boundaries between two different regions, an important factor in assessing the quality of a mission plan is how the set of chosen observations spatially cover the area of interest. The algorithm allows the rover to evaluate which observation to perform and to what extent the candidate observation will increase the spatial coverage of the plan.

This work was done by Daniel Gaines, Tara Estlin, and Caroline Chouinard of Caltech for NASA's Jet Propulsion Laboratory.

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44282.

Increasing the Life of a Xenon-Ion Spacecraft Thruster

A short document summarizes the redesign of a xenon-ion spacecraft thruster to increase its operational lifetime beyond a limit heretofore imposed by nonuniform ion-impact erosion of an accelerator electrode grid. A peak in the ion current density on the centerline of the thruster causes increased erosion in the center of the grid. The ion-current density in the NSTAR thruster that was the subject of this investigation was characterized by peak-to-average ratio of 2:1 and a peak-to-edge ratio of greater than 10:1. The redesign was directed toward distributing the same beam current more evenly over the entire grid andinvolved several modifications of the magnetic-field topography in the thruster to obtain more nearly uniform ionization. The net result of the redesign was to reduce the peak ion current density by nearly a factor of two, thereby halving the peak erosion rate and doubling the life of the thruster. (Note: NSTAR stands for NASA SEP Technology Application Readiness; SEP stands for solar electric propulsion.)

This work was done by Dan Goebel, James Polk, Anita Sengupta, and Richard Wirz of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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