Software

JWST Wavefront Control Toolbox

A Matlab-based toolbox has been developed for the wavefront control and optimization of segmented optical surfaces to correct for possible misalignments of James Webb Space Telescope (JWST) using influence functions. The toolbox employs both iterative and non-iterative methods to converge to an optimal solution by minimizing the cost function. The toolbox could be used in either of constrained and unconstrained optimizations. The control process involves 1 to 7 degrees-of-freedom perturbations per segment of primary mirror in addition to the 5 degrees of freedom of secondary mirror.

The toolbox consists of a series of Matlab/Simulink functions and modules, developed based on a "wrapper" approach, that handles the interface and data flow between existing commercial optical modeling software packages such as Zemax and Code V. The limitations of the algorithm are dictated by the constraints of the moving parts in the mirrors.

This work was done by Shahram Ron Shiri and David L. Aronstein of Goddard Space Flight Center. For further information, contact the Goddard Innovative Partnerships Office (301) 286-5810. GSC-15567-1

Java Image I/O for VICAR, PDS, and ISIS

This library, written in Java, supports input and output of images and metadata (labels) in the VICAR, PDS image, and ISIS-2 and ISIS-3 file formats. Three levels of access exist.

The first level comprises the low-level, direct access to the file. This allows an application to read and write specific image tiles, lines, or pixels and to manipulate the label data directly. This layer is analogous to the C-language "VICAR Run-Time Library" (RTL), which is the image I/O library for the (C/C++/Fortran) VICAR image processing system from JPL MIPL (Multimission Image Processing Lab). This low-level library can also be used to read and write labeled, uncompressed images stored in formats similar to VICAR, such as ISIS-2 and -3, and a subset of PDS (image format).

The second level of access involves two codecs based on Java Advanced Imaging (JAI) to provide access to VICAR and PDS images in a file-format-independent manner. JAI is supplied by Sun Microsystems as an extension to desktop Java, and has a number of codecs for formats such as GIF, TIFF, JPEG, etc. Although Sun has deprecated the codec mechanism (replaced by IIO), it is still used in many places. The VICAR and PDS codecs allow any program written using the JAI codec spec to use VICAR or PDS images automatically, with no specific knowledge of the VICAR or PDS formats. Support for metadata (labels) is included, but is format-dependent. The PDS codec, when processing PDS images with an embedded VIAR label ("dual-labeled images," such as used for MER), presents the VICAR label in a new way that is compatible with the VICAR codec.

The third level of access involves VICAR, PDS, and ISIS Image I/O plugins. The Java core includes an "Image I/O" (IIO) package that is similar in concept to the JAI codec, but is newer and more capable. Applications written to the IIO specification can use any image format for which a plug-in exists, with no specific knowledge of the format itself.

This work was done by Robert G. Deen and Steven R. Levoe of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-47184.

X-Band Acquisition Aid Software

The X-band Acquisition Aid (AAP) software is a low-cost acquisition aid for the Deep Space Network (DSN) antennas, and is used while acquiring a spacecraft shortly after it has launched. When enabled, the acquisition aid provides corrections to the antenna-predicted trajectory of the spacecraft to compensate for the variations that occur during the actual launch. The AAP software also provides the corrections to the antenna-predicted trajectory to the navigation team that uses the corrections to refine their model of the spacecraft in order to produce improved antenna-predicted trajectories for each spacecraft that passes over each complex.

The software provides an automated Acquisition Aid receiver calibration, and provides graphical displays to the operator and remote viewers via an Ethernet connection. It has a Web server, and the remote workstations use the Firefox browser to view the displays. At any given time, only one operator can control any particular display in order to avoid conflicting commands from more than one control point. The configuration and control is accomplished solely via the graphical displays. The operator does not have to remember any commands. Only a few configuration parameters need to be changed, and can be saved to the appropriate spacecraft-dependent configuration file on the AAP's hard disk.

AAP automates the calibration sequence by first commanding the antenna to the correct position, starting the receiver calibration sequence, and then providing the operator with the option of accepting or rejecting the new calibration parameters. If accepted, the new parameters are stored in the appropriate spacecraft-dependent configuration file. The calibration can be performed on the Sun, greatly expanding the window of opportunity for calibration. The spacecraft traditionally used for calibration is in view typically twice per day, and only for about ten minutes each pass.

This work was done by Michael J. Britcliffe and Martha M. Strain of Caltech and Michael Wert of ITT for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

The software used in this innovation is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-47004.