the current estimate of the exit pupil wavefront. This estimated PSF is then deconvolved from the image data to provide an estimate of the object. At this point, one has an estimate of the object, and the estimated wavefront. The process is then repeated with the object included in the model in VSM. The entire process is repeated until a convergence criterion is met.

This work was done by Jeffrey Smith for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15963-1

3D Drop Size Distribution Extrapolation Algorithm Using a Single Disdrometer

Multiple sensors are not required for successful implementation of the 3D interpolation/extrapolation algorithm.

John F. Kennedy Space Center, Florida

Determining the Z-R relationship (where Z is the radar reflectivity factor and R is rainfall rate) from disdrometer data has been and is a common goal of cloud physicists and radar meteorology researchers. The usefulness of this quantity has traditionally been limited since radar represents a volume measurement, while a disdrometer corresponds to a point measurement. To solve that problem, a 3D-DSD (drop-size distribution) method of determining an equivalent 3D Z-R was developed at the University of Central Florida and tested at the Kennedy Space Center, FL. Unfortunately, that method required a minimum of three disdrometers clustered together within a microscale network (≈1-km separation). Since most commercial disdrometers used by the radar meteorology/cloud physics community are high-cost instruments, three disdrometers located within a microscale area is generally not a practical strategy due to the limitations of these kinds of research budgets.

A relatively simple modification to the 3D-DSD algorithm provides an estimate of the 3D-DSD and therefore, a 3D Z-R measurement using a single disdrometer. The basis of the horizontal extrapolation is mass conservation of a drop size increment, employing the mass conservation equation. For vertical extrapolation, convolution of a drop size increment using raindrop terminal velocity is used. Together, these two independent extrapolation techniques provide a complete 3D-DSD estimate in a volume around and above a single disdrometer. The estimation error is lowest along a vertical plane intersecting the disdrometer position in the direction of wind advection.

This work demonstrates that multiple sensors are not required for successful implementation of the 3D interpolation/extrapolation algorithm. This is a great benefit since it is seldom that multiple sensors in the required spatial arrangement are available for this type of analysis.

The original software (developed at the University of Central Florida, 1998—2000) has also been modified to read standardized disdrometer data format (Joss-Waldvogel format). Other modifications to the software involve accounting for vertical ambient wind motion, as well as evaporation of the raindrop during its flight time.

This work was done by John Lane of ASRC Aerospace Corporation for Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13302

Social Networking Adapted for Distributed Scientific Collaboration

Sci-Share provides scientists with a set of tools for e-mail, file sharing, and information transfer.

Goddard Space Flight Center, Greenbelt, Maryland

Sci-Share is a social networking site with novel, specially designed feature sets to enable simultaneous remote collaboration and sharing of large data sets among scientists. The site will include not only the standard features found on popular consumer-oriented social networking sites such as Facebook and Myspace, but also a number of powerful tools to extend its functionality to a science collaboration site.

A Virtual Observatory is a promising technology for making data accessible from various missions and instruments through a Web browser. Sci-Share augments services provided by Virtual Observatories by enabling distributed collaboration and sharing of downloaded and/or processed data among scientists. This will, in turn, increase science returns from NASA missions. Sci-Share also enables better utilization of NASA's high-performance computing resources by providing an easy and central mechanism to access and share large files on users' space or those saved on mass storage.

The most common means of remote scientific collaboration today remains the trio of e-mail for electronic communication, FTP for file sharing, and personalized Web sites for dissemination of papers and research results. Each of these tools has well-known limitations. Sci-Share transforms the social networking paradigm into a scientific collaboration environment by offering powerful tools for cooperative discourse and digital content sharing. Sci-Share differentiates itself by serving as an online repository for users' digital content with the following unique features:

- Sharing of any file type, any size, from anywhere;
- Creation of projects and groups for controlled sharing;

- Module for sharing files on HPC (High Performance Computing) sites;
- Universal accessibility of staged files as embedded links on other sites (e.g. Facebook) and tools (e.g. e-mail);
- Drag-and-drop transfer of large files, replacing awkward e-mail attachments (and file size limitations);
- Enterprise-level data and messaging encryption; and
- Easy-to-use intuitive workflow.

This work was done by Homa Karimabadi of Goddard Space Flight Center. Further information is contained in a TSP (see page 1).
GSC-15883-1

General Methodology for Designing Spacecraft Trajectories

Lyndon B. Johnson Space Center, Houston, Texas

A methodology for designing spacecraft trajectories in any gravitational environment within the solar system has been developed. The methodology facilitates modeling and optimization for problems ranging from that of a single spacecraft orbiting a single celestial body to that of a mission involving multiple spacecraft and multiple propulsion systems operating in gravitational fields of multiple celestial bodies. The methodology consolidates almost all spacecraft trajectory design and optimization problems into a single conceptual framework requiring solution of either a system of nonlinear equations or a parameter-optimization problem with equality and/or inequality constraints.

The use of multiple reference frames that generally translate, rotate, and pulsate between two arbitrary celestial bodies facilitates analysis of such complex trajectories as those that pass (possibly multiple times) through gravitational fields of multiple celestial bodies. A basic building block that can accommodate impulsive maneuvers, maneuver- and non-maneuver-based mass discontinuities, and finite burn or finite control acceleration maneuvers, is used to construct trajectories. The methodology is implemented in an interactive computer program, COPERNICUS, wherein numerical integration, multi-dimensional nonlinear root-finding, and/or sequential quadratic programming are used for solving trajectory design, targeting, or optimization problems constructed by the analyst.

This work was done by Gerald Condon of Johnson Space Center; Cesar Ocampo, Ravishankar Mathur, and Fady Morcos of the University of Texas; Juan Senent of Odyssey Space Research; Jacob Williams of ERC, Inc.; and Elizabeth C. Davis of Jacobs Technology. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.
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