Cloud Absorption Radiometer Autonomous Navigation System — CANS

The system captures navigational data in real time while keeping the sensor centered on a fixed target.

Goddard Space Flight Center, Greenbelt, Maryland

CAR (cloud absorption radiometer) acquires spatial reference data from host aircraft navigation systems. This poses various problems during CAR data reduction, including navigation data format, accuracy of position data, accuracy of airframe inertial data, and navigation data rate. Incorporating its own navigation system, which included GPS (Global Positioning System), roll axis inertia and rates, and three-axis acceleration, CANS expedites data reduction and increases the accuracy of the CAR end data product.

CANS provides a self-contained navigation system for the CAR, using inertial reference and GPS positional information. The intent of the software application was to correct the sensor with respect to aircraft roll in real time based upon inputs from a precision navigation sensor. In addition, the navigation information (including GPS position), attitude data, and sensor position details are all streamed to a remote system for recording and later analysis.

CANS comprises a commercially available inertial navigation system with integral GPS capability (Attitude Heading Reference System—AHRS) integrated into the CAR support structure and data system. The unit is attached to the bottom of the tripod support structure. The related GPS antenna is located on the P-3 radome immediately above the CAR. The AHRS unit provides a RS-232 data stream containing global position and inertial attitude and velocity data to the CAR, which is recorded concurrently with the CAR data. This independence from aircraft navigation input provides for position and inertial state data that accounts for very small changes in aircraft attitude and position, sensed at the CAR location as opposed to aircraft state sensors typically installed close to the aircraft center of gravity. More accurate positional data enables quicker CAR data reduction with better resolution.

The CANS software operates in two modes: initialization/calibration and operational. In the initialization/calibration mode, the software aligns the precision navigation sensors and initializes the communications interfaces with the sensor and the remote computing system. It also monitors the navigation data state for quality and ensures that the system maintains the required fidelity for attitude and positional information. In the operational mode, the software runs at 12.5 Hz and gathers the required navigation/attitude data, computes the required sensor correction values, and then commands the sensor to the required roll correction. In this manner, the sensor will stay very near to vertical at all times, greatly improving the resulting collected data and imagery.

CANS greatly improves quality of resulting imagery and data collected. In addition, the software component of the system outputs a concisely formatted, high-speed data stream that can be used for further science data processing. This precision, time-stamped data also can benefit other instruments on the same aircraft platform by providing extra information from the mission flight.

This work was done by Duncan Kahle of Goddard Space Flight Center, Charles Gatebe of the University of Baltimore, Bill McCune of Adaptive Aerospace, and Dustan Hellwig of Chesapeake Technology International. Further information is contained in a TSP (see page 1). GSC-16395-1

Software Method for Computed Tomography Cylinder Data Unwrapping, Re-slicing, and Analysis

Visualization of the data is possible in one view without having to rotate the volume rendering.

John H. Glenn Research Center, Cleveland, Ohio

A software method has been developed that is applicable for analyzing cylindrical and partially cylindrical objects inspected using computed tomography (CT). This method involves unwrapping and re-slicing data so that the CT data from the cylindrical object can be viewed as a series of 2D sheets (or flattened "onion skins") in addition to a series of top view slices and 3D volume rendering. The advantages of viewing the data in this fashion are as follows: (1) the use of standard and specialized image processing and analysis methods is facilitated having 2D array data versus a volume rendering; (2) accurate lateral dimensional analysis of flaws is possible in the unwrapped sheets versus volume rendering; (3) flaws in the part "jump out" at the inspector with the proper contrast expansion settings in the unwrapped sheets; and (4) it is much easier for the inspector to locate flaws in the unwrapped sheets versus top view slices for very thin cylinders. The method is fully automated and requires no input from the user except proper voxel dimension from the CT experiment and wall thickness of the part.

The software is available in 32-bit and 64-bit versions, and can be used with binary data (8- and 16-bit) and BMP type CT image sets. The software has memory (RAM) and hard-drive based modes. The advantage of the (64-bit) RAM-based mode is speed (and is very practical for users of 64-bit Windows operating