MAE/GSA

"Future of Research Seminar"

"International Space Station Leak Localization Using Attitude Response Data"

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A new method is presented to determine an air leak on the International Space Station from the attitude response, which is caused by the reaction force of the air flowing through a perforated hole. The vent thrust can yield a strong reaction torque, depending on the size and location of the leak. A perforated hole on the surface of a pressurized module can be modeled as a short nozzle with the forced air acting as the propellant. With this nozzle model an extended Kalman filter is used to estimate the vent thrust magnitude from internal pressure measurements. The vent torque, which is not explicitly modeled in the attitude dynamics, shows up as a residual disturbance torque in the filtering process. Problems may arise in the accuracy of the vent torque estimates when significant inertia modeling errors and external disturbances are present. Therefore, parameter estimation methods are employed to estimate these uncertainties when no leak acts on the spacecraft. Assuming that the leak is caused by a single hole, the possible locations of the air leak are then calculated using the estimated vent torque, vent thrust magnitude, and the actual geometric structure of the pressurized segments. There may be single or multiple leak locations that produce the same attitude response. To reduce the number of possible solutions, conventional methods are combined with the new leak localization method.

206 Furnas Hall
Thursday, February 24, 2005
Refreshments – 3:00 pm
Seminar 3:30 pm – 4:30 pm