

ASTRODYNAMICS SYMPOSIUM (C1)  
Attitude Dynamics and Control (9)

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MEASUREMENT OF THE SOLAR ARRAY PANEL'S VIBRATION CAUSED BY THERMAL SNAP  
AND DELTA-V USING MONITOR CAMERAS ON THE GREENHOUSE GASES OBSERVING  
SATELLITE (GOSAT)

**Abstract**

Degradation of the attitude stability of low Earth orbiting satellites at the beginning and the end of the eclipse was known for years. Cause of the degradation of the attitude stability is believed to be vibration of the solar array panels caused by the thermal shock. When the low Earth orbiting satellites go through the eclipse, rapid cool down of their solar array panels occurs and after the eclipse rapid heating occurs. These rapid heating and rapid cool down produce temperature differences between both sides of the solar array panels and produce unequal thermal expansion and shrink of the solar array panels. The unequal thermal expansion and shrink will disappear after the temperature difference between the both sides of the solar array panels become moderate. These thermal expansion and shrink of the solar array panels produce vibration of the solar array panels and result the degradation of the satellite attitude stability. These phenomena are called the "thermal snap". However these phenomena are rarely observed or measured since the motions of the solar array panels caused by the thermal snap are very slow and are difficult to measure by sensors such as accelerometers. It is also difficult to observe the vibration by a camera since the vibration occurs at the beginning and the end of the eclipse where lighting conditions for monitor camera are not good to take images of the satellite's solar array panels.

JAXA is measuring this thermal snap of the solar array panels using CMOS cameras mounted on the Greenhouse gases Observing Satellite (GOSAT) that was launched in January 2009. Vibration measurements are made by measuring spatial orientation of the edge of the solar paddles. In order to make it easy to identify the edge of the solar paddle, visual markers made of optical reflecting tape are attached at the end of the solar paddles. Images taken by the camera are processed on ground. The GOSAT satellite was launched in January 2009 and is now under the initial check out. During the delta-V maneuvers to locate the satellite into the operation orbit, images of the solar panels were taken and the image data processing showed vibration of the solar panels after the thruster firing. Detailed measurement results will be reported in the final paper and at the conference.