

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

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THERMAL DESIGNING AND ANALYSIS USING ANSYS FOR 'PRATHAM' STUDENT SATELLITE
IIT BOMBAY**Abstract**

'Pratham' is the first satellite under the Indian Institute of Technology Bombay (IIT Bombay) Student Satellite Project. This paper provides a brief overview of thermal subsystem. The objective of the subsystem is to ensure the temperature management of the satellite so that it survives under different thermal loads.

The design approach has been briefly explained. A CAD model of the satellite is prepared and it is then meshed to obtain Transient Thermal analysis in ANSYS. Different loads of heat flux and internal heat generation and solar radiation is applied. Some of the features like Multilayer Insulation (MLI) and Optical Solar Reflector (OSR) window have been incorporated for thermal control.

All satellite sides will be black anodized from inside. Heat sink is used for power amplifier in telemetry and beacon boards. 4 sides are to be covered by MLI blankets. High dissipation components are placed on the PCB using thermal filler materials. Solar panels back side will be covered with low emittance tape. Monopole holder is covered with MLI blanket. Monopole is polished without applying any coating. OSR requirement for the satellite is on the anti-sun side panel. Heat shrinkable tubes between holder and monopole are used.

The analyses were done in steps. In the first step a simple hollow cube with heat flux and radiation is applied. This model helps to understand the interface of ANSYS and basics of simulation. Next steps model used the complete satellite model with removed those minor parts which did not contribute to thermal coupling to reduce the analysis time. Second model gave approximate result in less time which helped in different frequent design iteration. The final design was modeled and analyzed with complete thermal condition which finally gone through different iteration depending on constrained by other subsystems.

The thermals sub-system has started a new initiative called as virtual laboratory which is openly available on the website of Pratham. Virtual laboratory gives the data of solar heat flux for different orbital altitude and inclination.

All the thermal analysis were done in ANSYS and IDEA-S using the parallel processing feature on server to reduce the analysis time. Using the thermal field obtained thermal stress was analyzed.