Thermal Analysis of Solar Array Panels with Temperature-Varying Absorptivity

Case Study

OVERVIEW

SolAero Technologies Corp. is a leading provider of high efficiency solar cells, solar array panels (SAPs), and composite structural products for satellite and aerospace applications. SolAero needed thermal analysis performed on their SAP design that had temperature-dependent absorptivities. Current commercial software does not offer a standard capability for this type of analysis.

Since radiative heat loads are calculated prior to the simulation, temperature dependence cannot be modeled, and re-calculating the heat loads during the simulation is computationally expensive and would dramatically increase the solve time. Therefore, to meet this need, ATA supported SolAero by developing a subroutine in Thermal Desktop® and performing the thermal analyses.

TASKS PERFORMED & KEY OUTCOMES

➤ Developed thermal model of the SAPs and associated satellite.
➤ Defined thermal coupling and resistances between components.
➤ Developed subroutines in Thermal Desktop® that computed the average temperature for each SAP and computed the solar heat loads given the SAP temperature-dependent absorptivity.
➤ Performed thermal analyses for multiple on-orbit load cases.
➤ Documented the SAP maximum, minimum, and average temperatures as a function of time for the given on-orbit load cases.
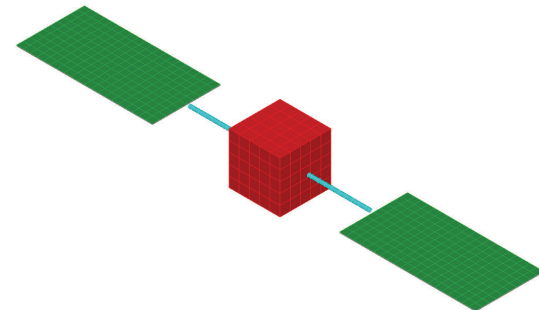
Generic representation of SolAero SAPs and customer's Satellite
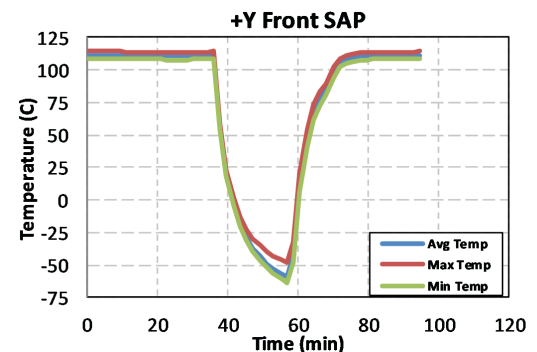
Maximum/Minimum temperatures of front side of +Y SAP as a function of time