# VIOLET SATELLITE PROJECT

By *ANSYS Advantage* Staff

Violet is a highly agile nano-satellite whose primary mission is to experimentally validate novel control-moment gyroscope (CMG) steering laws. It is Cornell University's entry in the University Nanosat-6 Competition, following Cornell's successful CUSat program. Violet is intended to demonstrate new CMG steering laws along with an operationally responsive, high-agility space imaging system. Total mission success involves validation of a high-agility nanosatellite architecture and spectral analysis of Earth's upper atmosphere.

The Air Force Research Lab (AFRL), which helps administer the competition, requires that the internal configuration of structural walls must provide adequate stiffness to the spacecraft: The first fundamental frequency must be greater than 100 Hz when given a fixed-base constraint. The end goal is to verify that the satellite structure can withstand potentially damaging vibrations that occur during launch. Cornell student engineers performed modal analysis of the empty spacecraft with ANSYS Mechanical. Then they verified the accuracy of the empty spacecraft simulation model with a physical hammer test. "The structural FEA model predicted the first mode of the empty satellite at a value that validated the accuracy of the empty spacecraft model," says Robert McBride, Cornell undergraduate student. Next, students performed the same ANSYS simulation with the fully loaded spacecraft to ensure that the vehicle has a first modal frequency above the required 100 Hz. Students validated that the wall structure provides adequate strength and that deflections of components attached to the walls do not interfere with other components during 20 g loading. ∧
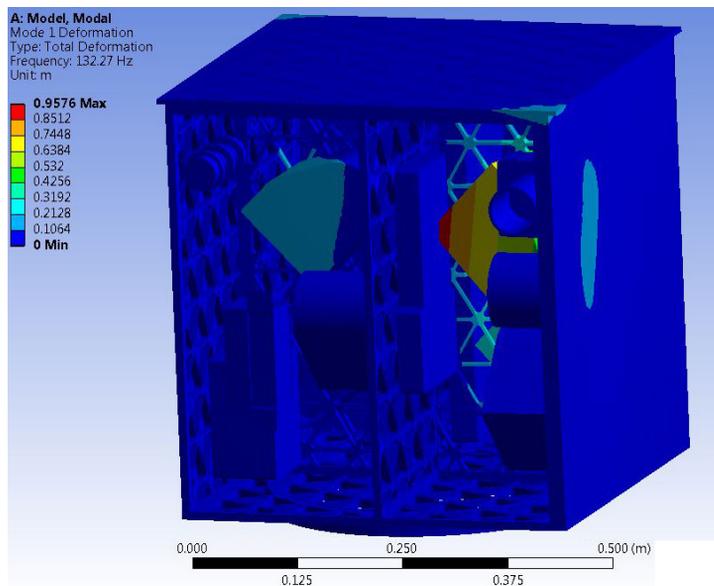
Modal analysis for Cornell's nanosatellite ensured that the structural walls provide adequate stiffness during launch.

Cornell student engineers performed modal analysis of the empty spacecraft using ANSYS Mechanical.

Learning Experience
ANSYS and Cornell University have developed a unique collaboration that has flourished for well over a decade, helping to extend Cornell's reputation as one of the world's leading research institutions. ANSYS software is used by students and teachers in the classroom as well as by project teams and researchers to solve challenging mechanical and fluid-flow problems.

Reference
Cornell University Space Systems Design Studio, Violet Satellite Project cusat.cornell.edu/violet