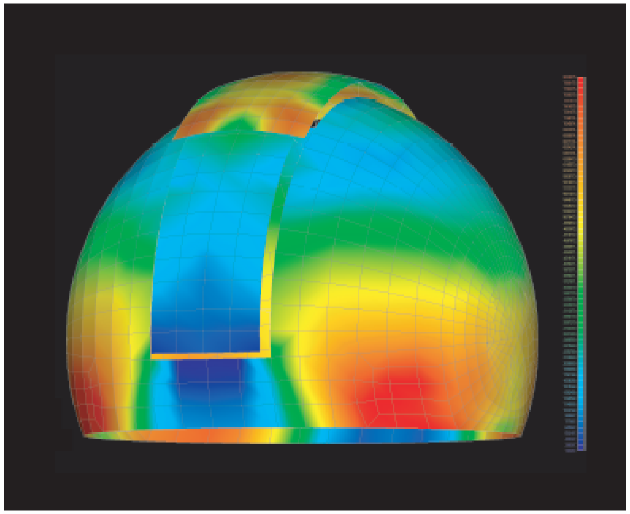
NEiNastran

Civil Applications (SOAR Observatory)

SOAR Observatory – Cerro Pachon, Chile



NEiNastran FEA Model – Dome & Shutter Assembly

The Southern Astrophysical Research (SOAR) Telescope is a 4.2-meter, clear-aperture optical/IR telescope on Cerro Pachon in the Chilean Andes. Completed in July of 2002, the $28 million dollar telescope produces images that rival the clarity of the Hubble Space Telescope. The SOAR telescope dome is a $2 million dollar, 66-foot diameter, weatherproof structure weighing over 70 tons. The dome consists of an internal steel frame covered with lightweight glass composite panels, an over-the-top nesting shutter system, rotational friction drive, and overhead crane.

The primary objective of the SOAR project: build a high quality, low cost telescope facility. The challenge facing engineers: design a domed enclosure that would be simple to implement, fabricate, and integrate on-site. To protect the sensitive instruments inside, the dome had to withstand a variety of internal external loadings, including severe wind and ice conditions. The dome, shutter, and windscreen must also precisely “track” the telescope’s movements and maintain a 5-meter square clear aperture around the line-of-sight. NEiNastran was chosen to perform the finite element analysis of the entire internal structure and composite dome panels.

NEiNastran was used to verify the overall structural adequacy of the dome under critical load conditions including wind, snow, and ice. The internal steel frame and composite exterior panels were modeled together in NEiNastran to take advantage of the substantial stiffening the panels provide. Structural deflections, stresses, and member loads were studied under both static conditions and the load path variations found during dome rotation. NEiNastran was also used to determine interlaminar shear stress, stiffness, and laminate failure indices of the panels themselves.

NEiNastran completely verified the structural integrity of the composite dome and internal frame under a variety of critical structural and environment load conditions. Critical members were re-sized based on worst-case deflection results from the NEiNastran analysis. Conclusion: the primary frame and exterior panels could withstand the various loads generated by and on the dome, while maintaining deflections within an acceptable range. NEiNastran delivered a precise, accurate, and cost-effective solution to this critical scientific design challenge.

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