

2008 SEI STRUCTURES CONGRESS SESSION PROPOSAL

Proposed Session: Large Moveable Structures

Topic: Large Moveable Structures: European Extremely Large Telescope Enclosure

Presentation Abstract:

By the end of the Twentieth century, the development of new technologies, such as segmented mirrors and adaptive optics, have allowed for an increase in the maximum feasible diameter of telescopes with diffraction limited resolution. While several feasibility studies have been carried out on this topic, the technological limit for the maximum diameter of this new generation of telescopes is not yet clear.

In Europe, after some previous studies performed by the European Space Organization (OWL) and the University of Lund in Sweden (EURO50), the European Community focused its efforts on the design of a new telescope concept - the European Extremely Large Telescope (E-ELT). The Baseline Reference Design for the E-ELT considers a 42m diameter primary mirror. One can appreciate the large scale of this structure when compared to the largest diffraction telescope ever built (10.4m). The enclosure design for this new generation telescope involves large, movable structures which have tremendous high demands on tolerances, serviceability, environmental and operational requirements. The complexity of the enclosure structure is commensurate with the scale of the system.

In the last decade, large, movable structures have become more common for sports stadiums, pools, shipyards and/or bridges. However, there are no guidelines or well-documented systematic approaches to assist in mitigating the risks usually involved with these large scale projects which could provide some measure of confidence in the design approach. Malfunctions in existing movable structures are common, and have involved failures in the structure, mechanisms, control or the sealing systems. The failure of any single component in this chain may lead to an inability to open and close the entire structure. Large movable structures also provide challenges between design disciplines that are not always as dependant and interconnected – such as large structural and mechanism design and control methodology. Designing the control laws governing this type of system requires a deep understanding of the behavior of the structure and the mechanisms, as well as the electrical control theory.

This presentation will focus on the holistic design approach necessary for these complex moveable structures, with examples from the design challenges surrounding the preliminary designs for the E-ELT moveable enclosure structure.

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