

Next generation lightweight mirror modeling software

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ABSTRACT

The advances in manufacturing techniques for lightweight mirrors, such as EXELSYS deep core low temperature fusion, Corning's continued improvements in the Frit bonding process and the ability to cast large complex designs, combined with water-jet and conventional diamond machining of glasses and ceramics has created the need for more efficient means of generating finite element models of these structures. Traditional methods of assembling 400,000 + element models can take weeks of effort, severely limiting the range of possible optimization variables. This paper will introduce model generation software developed under NASA sponsorship for the design of both terrestrial and space based mirrors. The software deals with any current mirror manufacturing technique, single substrates, multiple arrays of substrates, as well as the ability to merge submodels into a single large model. The modeler generates both mirror and suspension system elements, suspensions can be created either for each individual petal or the whole mirror. A typical model generation of 250,000 nodes and 450,000 elements only takes 5-10 minutes, much of that time being variable input time. The program can create input decks for ANSYS, ABAQUS and NASTRAN. An archive/retrieval system permits creation of complete trade studies, varying cell size, depth, and petal size, suspension geometry with the ability to recall a particular set of parameters and make small or large changes with ease. The input decks created by the modeler are text files which can be modified by any editor, all the key shell thickness parameters are accessible and comments in deck identify which groups of elements are associated with these parameters. This again makes optimization easier. With ANSYS decks, the nodes representing support attachments are grouped into components; in ABAQUS these are SETS and in NASTRAN as GRIDPOINT SETS, this make integration of these models into large telescope or satellite models possible.