# FEM Correlation and Shock Analysis of a VNC MEMS Mirror Segment

E. Aguayo[1], R. Lyon[2], M. Helmbrecht[3], S. Khomusi[1]

[1]The Newton Corporation, Bowie, MD, USA
[2]NASA Goddard Space Flight Center, Greenbelt, MD, USA
[3]Iris AO, Inc., Berkeley, CA, USA

## Abstract

Microelectromechanical systems (MEMS) are becoming more prevalent in today's advanced space technologies. The Visible Nulling Coronagraph (VNC) instrument, being developed at the NASA Goddard Space Flight Center, uses a MEMS Mirror to correct wavefront errors. This MEMS Mirror, the Multiple Mirror Array (MMA), is a key component that will enable the VNC instrument to detect Jupiter and ultimately Earth size exoplanets.

Like other MEMS devices, the MMA faces several challenges associated with spaceflight. Therefore, Finite Element Analysis (FEA) is being used to predict the behavior of a single MMA segment under different spaceflight-related environments. Finite Element Analysis results are used to guide the MMA design and ensure its survival during launch and mission operations. A Finite Element Model (FEM) has been developed of the MMA using the COMSOL Multiphysics® software. This model has been correlated to static loading on test specimens. The correlation was performed in several steps—simple beam models were correlated initially, followed by increasingly complex and higher fidelity models of the MMA mirror segment. Subsequently, the model has been used to predict the dynamic behavior and stresses of the MMA segment in a representative spaceflight mechanical shock environment. The results of the correlation and the stresses associated with a shock event are presented herein.