The Habitable Exoplanet Imager (HabEx) is a space telescope currently in development whose mission includes finding and spectroscopically characterizing exoplanets. Effective high-contrast imaging requires tight stability requirements of the mirrors to prevent issues such as line of sight and wavefront errors. PATRAN and NASTRAN were used to model updates in the design of the HabEx telescope and find how those updates affected stability. Most of the structural modifications increased first mode frequencies and improved line of sight errors. These studies will be used to help define the baseline HabEx telescope design.

Science Behind HabEx Technical Requirements

- Exoplanets are difficult to directly image due to their home star’s glare which can be billions of times brighter than the planet’s reflected light.
- Blocking the light from the star is possible with a coronagraph.
- The coronagraph has tight stability tolerances for the optical surfaces.
- Technical challenges involve creating a telescope which is stiff enough to prevent deflections of the primary mirror in the realm of nanometers.

Methods

- Utilized PATRAN for finite element modeling and pre-processing
- Modeled and meshed JPL Spacecraft BUS
- Integrated various design modifications into full finite element model (FFM)

Results

- Utilized NASTRAN to perform dynamic and modal analyses
- Using a prepared MATLAB script, performed line of sight and jitter calculations
- Used a prepared Excel Workbook for applying isolation filters to data
- Finite element model of the full assembly was constantly changing throughout the analysis process

Acknowledgments

Thanks to my mentor Phil Stahl for helping me become part of this optics community and giving me help where needed. Thanks to Jay Garcia in the Advanced Concepts Office for teaching me about structural analysis and engineering everyday.