**6 DOF with variable mass and inertia**

Various topics were provided for this research opportunity. Among those topics, I choose the topic related to 6 DOF with variable mass and inertia of a spacecraft. As I am an aerospace minor and mechanical major, the independent research opportunity will help me to gain deeper insight on the dynamics of spacecraft, which would help me towards my minor. Moreover, this topic is very interesting and amazing. I would passionately work towards understanding all the sub-topics and complete the research in designated time. Till now, I have been able to understand the translation of spacecraft in three axes (x, y, z), using the understanding from the dynamics class. After that I have started working towards understanding rotation of the spacecraft. I made myself familiar with the Euler’s angle and Euler’s parameter. The use of Euler’s angle subjected the aircraft to the problem of singularity-commonly known as gimble lock, where two axes align with each other and produce same rotation. To avoid this problem, Euler’s parameter was introduced, where quaternions are used to describe the rotation of the body. At present, I am working towards understanding the use of quaternions to describe the rotation.