Full Annual Chapter Report

2018-2019

Alabama Delta Upsilon

A. Inititations

For our chapter, initiation selection greatly involves the faculty. There is a running list kept by the Mechanical Engineering Department at the University of Alabama in Huntsville (UAH). This list is updated before initiations to accurately reflect academic standing. This list is then collected by the student chapter heads and used to determine eligibility for Pi Tau Sigma. Following this, all students who qualify will be reached out to via email and informed that they have qualified. There is then individual communication to answer any questions. Then all interested individuals are informed about the initiation dates, dress requirements, and initiation fee. The requirements are directly from the national website for PTS.

> "Undergraduate members shall be chosen from students on a basis of sound engineering ability, scholarship service, leadership, and integrity. Members shall be selected from eligible candidates currently in the last two years of their mechanical engineering program.
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> To be considered for election to undergraduate membership, a student's scholastic ranking must lie in the upper twenty-fifth (25) percentile of the student's respective classification with a grade point average greater than or equal to 3.25/4.0."

In addition, the rituals for initiation are pulled directly from the PTS National Website, these rituals were followed exactly, followed by a brief presentation given by the President and Vice President showing what we had done recently, what would be expected of new members, and what it means to be a part of Pi Tau Sigma.

Two initiations were held this academic year. Both were held in the Spring Semester. The first was held April 8th and had 26 initiates, and the second was held April 19th and had 5 initiates.

B. Chapter Activities

There were a few key activities this year for our chapter. The first of which took place during our school's week of welcome, which is a one-week wind-up to the school year primarily to welcome freshman to the campus. Our chapter set up a booth in conjunction with Engineers Without Borders to speak to new freshman and help them with any questions they might have about the school. In addition, the PTS section of the booth was used to talk to people about interview etiquette, teach them how to tie ties and bowties, and inform them about ongoing research on campus so they could see what the professors do as engineers. We

also gave out information about what Pi Tau Sigma is, how to get involved, and what the requirements are.

Another activity our chapter participated in was attending a research presentation by Dr. Masatoshi Hirabayashi who is a researcher involved in a joint mission between NASA, ESA, and JAXA along with many universities to investigate a top shaped asteroid. This was very interesting and really showed some incredible applications of our studies.

Bio:

Masatoshi (Toshi) Hirabayashi is an assistant professor of Aerospace Engineering at Auburn University. He graduated from an undergraduate school of Mechanical and Aerospace Engineering at Nagoya University in Japan in 2007 and obtained an M.S. degree in Aerospace Engineering at University of Tokyo in 2010. After moving to the U.S., he received an M.S. degree in 2012 and a Ph.D. degree in December in 2014 in Aerospace Engineering at University of Colorado Boulder. After establishing a scientific research experience in the Planetary Sciences group at Purdue University for two years, he joined Auburn in August 2017. Currently, he is leading the Space Technology Application Research (STAR) laboratory. His research focuses on using orbital mechanics, structure, impact physics, and planetary sciences to solve engineering and scientific problems in planetary missions. 11471 Toshihirabayashi is named after him as an honor to his contribution to planetary science communities. He has actively participated in multiple space missions. During his M.S. program, he was on the Hayabusa mission operation team (Japan's first asteroid sample return mission) and served as a primary engineer on the IKAROS mission team (World's first solar sail mission). He is currently a Co-I of the Optimal Navigation Camera (ONC) team of the Hayabusa2 mission (Japan's second asteroid sample return mission) and a participating scientist of the DART/AIDA (NASA-ESA joint) mission (World's first asteroid deflection mission).

Abstract: Geophysical structure of top-shaped rubble pile asteroids

Studies have shown that asteroids are rubble piles with irregular shapes. While the irregular shapes of large asteroids may be attributed to collisional events, those of small asteroids may result not only from impact events but also from rotationally induced deformation processes, a long-term consequence of small torques, for example, caused by solar radiation pressure. A typical asteroid shape that would be affected by such torques may be a round shape with a unique equatorial ridge, which is a so-called top-shape (see the figure). Observations have identified many top-shaped objects in Near Earth Asteroids (NEAs). A better understanding of the shape evolution of such asteroids allows us to give constraints on the evolution process of NEAs. Here, we use a finite element model (FEM) technique to analyze the failure modes and conditions of a top-shaped asteroid that was observed at high resolution by ground radar or asteroid exploration missions. Assuming that the material distribution is uniform, we investigate how a top-shaped asteroid would fail structurally at fast rotation. Our FEM simulations describe the detailed deformation mode at a fast spin. Critical structural failure consists of a vertical mode that makes the shape more oblate and a horizontal mode that pushes material outward in the radial direction. Our analysis suggests that if the material distribution is homogeneous, the internal deformation mode may be part of a contributor to the formation of the equatorial ridge of a top-shaped asteroid. This presentation will discuss analysis results given observational data.

In addition to these on-campus activities, our chapter resumed attending the National Convention after not attending last year, and had many chapter meetings with our advisor to discuss growing the organization and improving things like our website, outreach, and involvement.

C. Other

This was a rebuilding year for our organization, we raised our number of members significantly, cooperated with another society on campus, and resumed attending the national convention. Going into next year our chapter will have record numbers and will be on track to being in good standing.