A School of Engineering Seminar

Reducing Spacecraft Velocity Pointing Errors

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(Mechanical Engineering faculty candidate)

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1:10-2:00pm

SCI 256

Refreshments will be served – come join us!

Synopsis:

When a spacecraft performs an engine burn, the thruster misalignment (a consequence of assembly) causes the spacecraft to deviate from its desired trajectory. The majority of the velocity pointing error is produced by the step-function-like behavior of the thruster which almost instantaneously jumps from zero to its maximum value. Instead by ramping up the thruster, the velocity pointing error is greatly reduced.

Historically, the velocity pointing error has been reduced by spinning at a high rate (similar to a bullet). By reducing the pointing errors, the spacecraft saves fuel and lengthens its lifetime in one of two ways. The spacecraft has a smaller spin rate for the same pointing error of a typical thruster profile or has fewer in-course corrections with a smaller pointing error.

It has been shown that the velocity pointing error can be reduced by linearly ramping-up a thruster from zero to its maximum value. The first part of the presentation discusses analytical results for the linear ramp-up profile. The second part asks the question, "What is the optimal profile that minimizes the velocity pointing error?" Here ramp-up models such as exponential, parabolic, cubic, and cosine are considered. These profiles reduce the velocity pointing error beyond the linear profile to nearly zero and hence qualify as optimal solutions.

Speaker Bio:

Kaela Martin graduated from Iowa State University in 2010 with a B.S. in Aerospace engineering and a B.S. in mathematics. She received her Master's in Aeronautical and Astronautical Engineering from Purdue University in 2011. She is currently pursuing her doctorate at Purdue University in West Lafayette, Indiana with a research focus in spacecraft dynamics. In her spare time, Kaela enjoys spending time outside whether it is playing ultimate Frisbee, rock climbing, or backpacking in the wilderness.

For inquiries, please contact Ed Cheng at ascheng@sfsu.edu