Lecturer

Pavel Paces was born in Prague, Czech Republic, in 1978. He received the M.Sc. degree in aerospace engineering from the Faculty of Electrical Engineering, Czech Technical University in Prague, in 2005, with dean's award for his diploma thesis. He finished the Ph.D. degree in the same area in spring 2011 with Honeywell Innovator Award, Preciosa Award, two national patents and one US patent application.

He gained industrial experience as a programmer and tester of avionics instruments with DevCom LTD, as an HW and SW developer for the Aircraft Research Institute of the Czech Republic, etc. He experienced short stays at Beijing University of Aeronautics and Astronautics, Beijing – China; NASA Ames Research Center, Silicon Valley – USA; Cranfield University, Cranfield – UK; University of Sannio, Italy, Benevento – Italy; Surrey Satellite Technology Ltd. Guildford – England; and Honeywell International, Brno – Czech Republic.

Dr. Paces is member of the IEEE Aerospace and Electronic Systems Society and the American Institute of Aeronautics and Astronautics. Currently, he is a National Point of Contact for the Space Generation Advisory Council in support of the United Nations Program on Space Applications.

Course objectives

- Provide affordable and accessible lectures and information about Attitude Orbital and Control Systems
- Introduction of AOCS sensors, spacecraft systems and their characterization
- Hands-on experience with spacecraft control

Image credit: Pavel Paces.
Small Satellite Platform used for the hands on exercises.

Contact Information

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Short Course

Spacecraft Data Processing and Control Course

using Small Satellite Platform

for universities, institutes, summer schools, etc.

Image credit: NASA.
Hubble Space Telescope whose Attitude and Orbital Control System (AOCS) is introduced to students during hands on sessions of this course.

Course Introduction

The course is composed from lectures and workshop sessions introducing design and operation of an Attitude Orbital and Control Systems (AOCS). Despite high accuracy spacecrafts use 3D stabilization, the students will develop their own one axe control loop of the spacecraft (SSP). CovereTopics covered by the course include following:

- Spacecraft systems
- Spacecraft sensors, parameters and their applications
- Space environment and electronics
- Navigation algorithms and data processing
- Attitude control systems
- Introduction to the Small Satellite Platform and barometric formula
- Inner loops and reaction wheel control
- Magnetometer calibration and heading determination
- Accelerometers and body-to-navigation frame transformations
- Outer loop stabilization using
    - Earth's magnetic field
    - angular rate sensors
    - Star tracker sensors
- Sensor fusion and its usage for spacecraft stabilization

Example of the Course Schedule

The length and the content of the course can be scaled according to your requirements **from 1 minute** of basic explanation **to 5 days** full of different tasks. Example of one week content:

Day 1

Lecture: Introduction of the Small Satellite Platform (SSP) in general and description of the exercises in context of the present spacecraft technologies

Exercise: a) Introduction to the Small Satellite Platform, pressure sensor data acquisition and barometric formula
Exercise: b) SSP Reaction Wheel Speed and Load Measurement

Day 2

Lecture: Earth environment (mag. and grav. field) and its usage for a spacecraft control, space environment and electronics, space project management

Exercise: a) SSP Reaction Wheel Control
Exercise: b) Magnetometer Calibration and Heading Determination

Day 3

Lecture: Sensors, their characteristics and applications, Attitude Orbital and Control System

Exercise: a) SSP Magnetometer Independence
Exercise: b) SSP Stabilization with Help of Earth's Magnetic Field and Magnetometer

Day 4

Lecture: AOCS and redundancy, inner and outer control loops, navigation algorithms

Exercise: a) SSP Thermal Management and Its Influence on the Sensor's Precision
Exercise: b) SSP Stabilization Based on Angular Rate Sensors

Day 5

Lecture: SW development and back up

Exercise: a) SSP Star Tracker based stabilization
Exercise: b) Sensor fusion and its usage for spacecraft stabilization

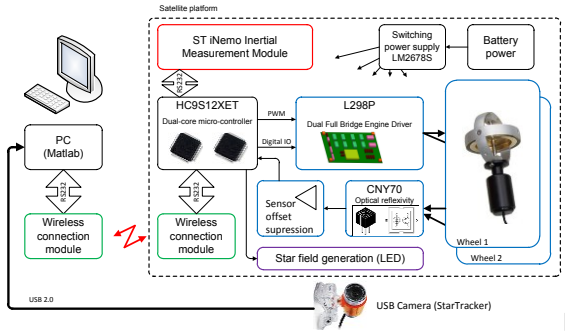

Image credit: Pavel Paces.
Block diagram of SSP that is used for the hands on exercises providing wireless access to accelerometers, angular speed sensors, vector magnetometer, reaction wheel with speed feedback, Star Tracker, etc.

Successful Stories

A) SSP is used during Board Information and Control Systems at CTU in Prague – three months program
B) SSP was used for a two weeks space technology course in Pakistan, Islamabad
C) SSP was used for a one day lecture at University of Calabria, Italy