

SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)  
On Track - Undergraduate And Postgraduate Space Education (2)

Author: Dr. Pavel Paces

Czech Technical University In Prague (CTU), Czech Republic, pacesp@feld.cvut.cz

Mr. Martin Sipos

Czech Technical University In Prague (CTU), Czech Republic, siposmar@feld.cvut.cz

Mr. Jaroslav Laifr

Czech Technical University In Prague (CTU), Czech Republic, laifrjar@fel.cvut.cz

Mr. Miroslav Batek

Czech Republic, miroslav.batek@gmail.com

SMALL SATELLITE SYSTEMS CONTROL FOR UNIVERSITY CURRICULUM

**Abstract**

We live in time where astronauts are no more heroes, space shuttle has retired and interest of people in space decreases. This article describes an electro-mechanical laboratory model of a spacecraft dedicated to demonstrate selected principles currently used in space with special intent to attract people back to space technologies. The model represents part of a microsatellite that allows its stabilisation and controlled movement in one axis. With this microsatellite we are able to demonstrate: microsatellite stabilisation with help of reaction wheels, inertial measurement unit function with coordinate system transformations, data acquisition and wireless data transfer, control loop design, star tracker functionalities and algorithm development. The students get mainly familiar with physical laws of mass motion in gravity free environment. Theoretical knowledge is then used for design of a control algorithm for spacecraft stabilisation. During the stabilisation task students acquire number of samples from inertial sensors and perform data analysis and sensor evaluation in order to determine sensor precision. The microsatellite stabilisation can be performed with help of the inertial measurement unit and an absolute measurement through its magnetometers or a relative measurement with help of angular speed sensors. Both measurements can be compared with results acquired from a star-tracker unit that allows precision evaluation of different measurements. The presented microsatellite gives opportunity to work on a spacecraft to student at different level of knowledge. They can compare their theoretical knowledge gained during lectures of Aerospace Monitoring and Control Systems subject and the real project working on the same principles as used in space. These activities are guided at Czech Technical University in Prague in Space Sciences specialisation with attention to attract more people for space and space technologies.