EE-583 **Spacecraft avionics architectures**

Storni Bruno

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.
Space technologies minor	E	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Summary

The course presents and analyses the different systems, architectures and components of spacecraft avionics (on board data handling and processing systems) controlling and commanding spacecraft and payloads (instruments). It will study typical bus structures (standard) used for S/C avionics.

Content

Introduction
Classification of spacecraft functions depending of mission profile and identification of requirements and functions of on board data handling systems
Architecture
Typical spacecraft structure, system and major subsystem, redundancy management, data flow, telematics, service module, payloads
Space environment threads to electronics systems and mitigation tecnics
On board electronics susceptibilty to space radiation environment, radiation hardness, radiation mitigation techniques, HW and SW error detection and correction
Components and subsystems
On board microprocessors and microcontrollers, on board communication buses and interfaces, mass memories, attitude and orbit control subsystems, payloads data processing, telemetry and telecommands
Standards and system modelisation
Modelisation of flight avioncs systems, spacecarft onboard interface services SOIS, Standard Space links protocols, standard data units, spacecraft synchronization time, buses and networks

www.ecss.nl
Cases studies
examples of flight avionics on International Space Station ISS, Automated Transfer Vehicle ATV, ExoMars (Rover, Lander and Orbiter)
Avionics on CAN
Exercices
Implement simple avioncs system components on an advanced design simulation and verification tool
http://vector.com/

Keywords

avionics
spacecraft telecommand/telemetry
intelligent distributed systems
spacecraft onboard interfaces services
space enviroment
spacecraft electronics,
rad hard components
on board processors and systems

ECSS communication standards

Learning Outcomes

By the end of the course, the student must be able to:

- Classify space mission on avionics requirements
- Analyze spacecraft avionics requirements
- Design flight avionics systems
- Model a distributed intelligent system on CAN base
- Order different on board communication bus systems
- Recognize threads and requirements for on board electronics components
- Implement a simulated avionics components on design tool
- Assess / Evaluate flight avionics requirements

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.

Teaching methods

Lecture with exercices in Space Center lab

Expected student activities

exercice on CANoe implement some function of an flight avionics system , based on distributed intelligent system peer to peer communication system CAN.

Resources

Notes/Handbook

Script handsout
ECSS standards