

EE-583

Spacecraft avionics architectures

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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 threats to electronics systems and mitigation technics

On board electronics susceptibility 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 avionics systems, spacecraft 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 avionics 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 environment
 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