Module Catalogue

for the Subject

Satellite Technology

as a Master’s with 1 major

with the degree "Master of Science"

(120 ECTS credits)

Examination regulations version: 2018
Responsible: Faculty of Mathematics and Computer Science
Responsible: Institute of Computer Science

Contents

The subject is divided into

Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen können erweiterte mathematische, regelungstechnischen und praktischen Grundlagen der Satellite Technology anwenden.
- Die Absolventinnen und Absolventen können tiefergehende Kenntnisse in mindestens einem Teilgebiet abrufen.
- Die Absolventinnen und Absolventen können fortgeschrittene hard- und/oder softwaregetriebene Experimente durchführen, analysieren, auswerten und die erhaltenen Ergebnisse darstellen.
- Die Absolventinnen und Absolventen sind in der Lage, sich mit Hilfe von Fachliteratur in neue Aufgabengebiete einzuarbeiten und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen besitzen Abstraktionsvermögen, analytisches Denken, Problemlösungskompetenz und die Fähigkeit, fortgeschrittene Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, fortgeschrittene Methoden der Satellite Technology auf konkrete praktische oder theoretische Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen setzen die erlernten theoretischen und praktischen Methoden in geschlossener Form ein, um zu zeigen, dass sie zur Anwendung der Konzepte wissenschaftlichen Arbeitens befähigt sind.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.
- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in einem Team zusammenzuarbeiten und auftretende Konflikte zu lösen (Teamfähigkeit).
- Die Absolventinnen und Absolventen können ihre erworbenen Kompetenzen in unterschiedlichen interkulturellen Kontexten und in international zusammengesetzten Teams anwenden.
- Die Absolventinnen und Absolventen kennen wichtige Anforderungen und Arbeitsweisen im gewerblichen Umfeld sowie in Forschung und Entwicklung.
- Die Absolventinnen und Absolventen sind befähigt, Probleme zu analysieren und zu lösen und sich in weniger vertraute Themenkomplexe einzuarbeiten.

Persönlichkeitsentwicklung

- Eigenverantwortlichkeit, Selbstständigkeit, Zeitmanagement, Teamfähigkeit
- Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und beachten sie.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.

Befähigung zum gesellschaftlichen Engagement

- Die Absolventinnen und Absolventen können Entwicklungen im Informationssektor kritisch reflektieren und deren Auswirkungen auf die Wirtschaft, Gesellschaft und die Umwelt in Ansätzen erfassen (Technikfolgenabschätzung).
- Die Absolventinnen und Absolventen haben ihr Wissen bezüglich wirtschaftlicher, gesellschaftlicher, kultureller etc. Fragestellungen erweitert und können in Ansätzen begründet Position beziehen.
- Die Absolventinnen und Absolventen entwickeln die Bereitschaft und Fähigkeit, ihre Kompetenzen in partizipative Prozesse einzubringen und aktiv an Entscheidungen mitzuwirken.

Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **V** = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2015

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

15-May-2018 (2018-35)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.

Compulsory Electives

(90 ECTS credits)

System Analysis

(20 ECTS credits)

Module title				Abbreviation
Space Physics				10-I-SP-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science VII	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

1. Overview 2. Dynamics of charged particles in magnetic and electric fields 3. Elements of space plasma physics 4. Sun and heliosphere 5. Acceleration and transport of energetic particles in the heliosphere 6. Instruments for measuring energetic particles in space.

Intended learning outcomes

The students possess a fundamental knowledge about space physics and, in particular, the description of the dynamics of charged particles in the heliosphere and in space. They are familiar with the relevant parameters, their theoretical formulation and the methods to measure them.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
Control Engineering in Space 1				10-I=CE1-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

Control engineering or control systems engineering is an engineering discipline that applies automatic control theory to design systems with desired behaviors in control environments. The practice uses sensors and detectors to measure the output performance of the process being controlled; these measurements are used to provide corrective feedback helping to achieve the desired performance. In this course, students obtain a first impression of system modelling of linear systems.

Intended learning outcomes

In this lecture the students should learn how to describe linear systems (differential equations or state space models). Using the above descriptions, linear systems are analysed in order to control vagaries in system output using feedback obtained from different sensors. Proportional, Differential and Integral controllers and their inner workings will also be learnt by the students. Control laws will be solved manually (on-paper) as well as in simulations using Matlab/SciPy.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
Computer Science for Space Engineering				10-I=CSSE1-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VII			Institute of Computer Science	
ECTS	**Method of grading**		**Only after succ. compl. of module(s)**	
5	numerical grade		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	graduate		--	
Contents				
The topics of this course cover the broad spectrum that is needed for programming satellite systems. This includes close-to hardware programming as well as high level topics such as virtual machines and concurrency. Algorithms and data structures form the frame, where the special topics of computer science for space engineering are taught.				
Intended learning outcomes				
In this lecture the students should learn advanced concepts of computer science. In addition to low-level programming and programming in C and C++, object oriented syntax and semantics of programming languages and efficient data structures are in focus of the course. In practical programming tasks/assignments within this module, students will be made familiar with virtual machines, such that they are enabled to set up their own virtual machine for a satellite system.				
Courses (type, number of weekly contact hours, language — if other than German)				
V (2) + Ü (2) Module taught in: English				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				
written examination (approx. 90 to 120 minutes) Language of assessment: English creditable for bonus				
Allocation of places				
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Additional information				
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Workload				
150 h				
Teaching cycle				
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Referred to in LPO I (examination regulations for teaching-degree programmes)				
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Module appears in				
Master's degree (1 major) Satellite Technology (2018)				

Module title				**Abbreviation**
Spacecraft System Analysis				10-I=SSA-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VIII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
10	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		
Contents				
Spacecraft system Analysis examines the design of spacecraft and launch vehicles, including the impacts of the atmosphere and the space environment on requirements and configurations. The principles and design aspects of the structure, propulsion, power, thermal, communication, and control subsystems are studied.				
Intended learning outcomes				
Students gain a general understanding of orbital mechanics & parameters and the subsystems of a spacecraft. This course handles the most important subsystems individually as listed in the table of contents. At the end of the course students will learn to translate mission requirements in to orbit and subsystem definitions. Thermal and Mechanical qualification including testing for space is additionally covered.				
Courses (type, number of weekly contact hours, language — if other than German)				
V (4) + Ü (2) + E (2) Module taught in: English				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				
written examination (approx. 90 to 120 minutes) and field trip report (4 to 8 pages) Language of assessment: English creditable for bonus				
Allocation of places				
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Additional information				
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Workload				
300 h				
Teaching cycle				
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Referred to in LPO I (examination regulations for teaching-degree programmes)				
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Module appears in				
Master's degree (1 major) Satellite Technology (2018)				

Module title			**Abbreviation**
Space Dynamics			10-I=SD-182-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science VII		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fundamental principles of astrodynamics, orientation control of satellites, sensors, actuators, control software, example realisations, spin-stabilised satellites, 3-axis stabilised satellites.

Intended learning outcomes

The students master the fundamentals of dynamic aspects of the design of spacecraft and are familiar with the essential sensors and actuators as well as their areas of use in spaceflight.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				**Abbreviation**
Selected Topics System Analysis				10-I=STSA-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		
Contents				
Selected topics in system analysis.				
Intended learning outcomes				
The students possess an advanced knowledge in the area of system analysis. They are able to understand solutions to complex problems in this area and to transfer them to related questions.				
Courses (type, number of weekly contact hours, language — if other than German)				
V (2) + Ü (2) Module taught in: English				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				
a) written examination (approx. 90 to 120 minutes) or b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic) or c) oral examination of one candidate each (approx. 20 minutes) or d) oral examination in groups (groups of up to 2 candidates, approx. 15 minutes per candidate) Language of assessment: English creditable for bonus				
Allocation of places				
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Additional information				
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Workload				
150 h				
Teaching cycle				
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Referred to in LPO I (examination regulations for teaching-degree programmes)				
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Module appears in				
Master's degree (1 major) Satellite Technology (2018)				

System Design

(30 ECTS credits)

Module title					Abbreviation
Telecommunication System Design					10-I=TSD-182-m01
Module coordinator				**Module offered by**	
holder of the Chair of Computer Science VII				Institute of Computer Science	
ECTS	**Method of grading**		**Only after succ. compl. of module(s)**		
10	numerical grade		--		
Duration		**Module level**	**Other prerequisites**		
1 semester		graduate	--		

Contents

The guidance and control of spacecraft depend on reliable communication. Scientific data returned to earth are irreplaceable, or replaceable only at the cost of another mission. In deep space, communications propagation is good, relative to terrestrial communications, and there is an opportunity to press toward the mathematical limit of microwave communication with reliability as well as channel capacity in mind. Further, the effects of small changes in the earth's atmosphere and the interplanetary plasma have small but important effects on propagation time and hence on the measurement of distance. This course presents a top-down approach to communications system design. The course will cover communication theory, algorithms and implementation architectures for essential blocks in modern physical-layer communication systems (antenna, coders and decoders, filters, multi-tone modulation, synchronization sub-systems).

Intended learning outcomes

At the end of the course, students will have gone through the complete process of designing a telecommunications system for a spacecraft including the subsystems described in the table of contents. All systems involved in end-to-end telecommunication chain including principal components for implementation will be discussed during the course.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title			**Abbreviation**
Performance Engineering and Benchmarking of Computer Systems			10-I=PEB-182-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science II		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.

Intended learning outcomes

The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)
Module studies (Master) Computer Science (2019)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title				Abbreviation
Remote Sensing				10-I=RS-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VIII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

Remote sensing refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation). It may be split into "active" remote sensing (i.e., when a signal is emitted by a satellite or aircraft and its reflection by the object is detected by the sensor) and "passive" remote sensing (i.e., when the reflection of sunlight is detected by the sensor).

Intended learning outcomes

The students learn the basics of earth observation. They outline and explain the radiation path through the atmosphere to the object under investigation and back to the sensor. They emphasize essential characteristics of remote sensing data, sensors and platforms.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title	Abbreviation
Control Engineering in Space 2	10-I=CE2-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science VII	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Students taking up this course are recommended to first complete Control Engineering in Space I. This course teaches advanced topics in control of dynamic systems specially related to space applications.

Intended learning outcomes

The students learn all necessary basics for the understanding of dynamic systems and their controllability by Kalman filters and their use in space applications. They are introduced to advanced controller and observer methods and realize the connections between the dual pairs controllability-observability and controller- and observer design as well as the relationship between Kalman filter as a state estimator and an observer.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title	Abbreviation
Advanced Sensory Systems and Sensor Data Processing	10-I=ASS-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science XVII	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Advanced automation systems need instrumentation concepts with proprioceptive and exteroceptive sensors. The sensors can be active or passive and may be enclosed into an embedded system. Only complex sensor systems and clever sensor data processing procedures ensure the tasks of satellite systems are performed in a reliable fashion. After discussing in detail state-of-the-art sensors and sensor systems, the course focuses on sensor data processing for in orbit and for planetary applications.

Intended learning outcomes

Students will master modern sensor data acquisition systems with embedded processing and several advanced data processing concepts, like sensor data interpretation. Advanced state estimation methods will be discussed within localization and mapping and students will have to deal with linear, non-linear filters (Kalman filter, extended Kalman filter, Unscented Kalman Filter, Particle filter, etc.). Furthermore, students should be able to put novel research strands in this area like machine learning concepts into a scientific and technological perspective and should be aware about the advantages and disadvantages.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title	Abbreviation
Trajectory Optimization and Reliability	10-I=TOR-182-m01

Module coordinator	Module offered by
Institute of Flight System Dynamics, Technical University Munich	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Aircraft trajectory optimization belongs to the mathematical field of optimal control. This means that the optimal control history and the optimal state history (and maybe other additional parameters) that minimize a given cost function for a given dynamic system need to be calculated. Thereby, all given initial and final boundary conditions as well as path equality and inequality constraints need to be fulfilled. This enables e.g. the calculation of noise minimal approach and departure trajectories for a given aircraft at a given airport considering the population distribution as well as any procedural requirements.

Intended learning outcomes

In this lecture the students should learn how to solve such optimal control problems beginning with the modeling of the required dynamic system as well as the cost and constraint functions. In the next steps on the one side theoretical optimality conditions are derived for simple examples and on the other side discretization techniques for the solution of realistic problems are introduced. Afterwards, methods for the solution of the resulting sparse parameter optimization problem are presented. Finally, other aspects related to the implementation are introduced.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				**Abbreviation**
Internship				10-I=P2-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents
A multidisciplinary aerospace project is being carried out. It covers areas such as mechanical components, electronics and software as well as theoretical aspects and algorithms from the corresponding project topic. Current and relevant topics from the research will be worked out. Students should plan, carry out and control their work. In the end, a fully functioning system should be developed. The complete work and its results are documented by means of a written document and presented in a final presentation.
Intended learning outcomes
Students learn to work independently on a scientific project and develop a working system at the end of this period.
Courses (type, number of weekly contact hours, language — if other than German)
R (6) Module taught in: English
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (project documentation (approx. 20 pages) with presentation (30 to 45 minutes) and subsequent discussion on the topic) Language of assessment: English
Allocation of places
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Additional information
Additional information on module duration: block taught sessions project, duration 4 to 6 weeks.
Workload
150 h
Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Satellite Technology (2018)

Module title				**Abbreviation**
Selected Topics System Design				10-I=STSD-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

Selected topics in system design.

Intended learning outcomes

The students possess an advanced knowledge in the area of system design. They are able to understand solutions to complex problems in this area and to transfer them to related questions.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 to 120 minutes) or
b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic) or
c) oral examination of one candidate each (approx. 20 minutes) or
d) oral examination in groups (groups of up to 2 candidates, approx. 15 minutes per candidate)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

System Implementation

(20 ECTS credits)

Module title				Abbreviation
Robotics 1				10-I=RO1-152-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science XVII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
8	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

History, applications and properties of robots, direct kinematics of manipulators: coordinate systems, rotations, homogenous coordinates, axis coordinates, arm equation. Inverse kinematics: solution properties, end effector configuration, numerical and analytical approaches, examples of different robots for analytical approaches. Workspace analysis and trajectory planning, dynamics of manipulators: Lagrange-Euler model, direct and inverse dynamics. Mobile robots: direct and inverse kinematics, propulsion system, tricycle, Ackermann steering, holonomes and non-holonome restrictions, kinematic classification of mobile robots, posture kinematic model. Movement control and path planning: roadmap methods, cell decomposition methods, potential field methods. Sensors: position sensors, speed sensors, distance sensors.

Intended learning outcomes

The students master the fundamentals of robot manipulators and vehicles and are, in particular, familiar with their kinematics and dynamics as well as the planning of paths and task execution.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 90 minutes)
creditable for bonus

Allocation of places

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Additional information

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IS,ES,LR,HCI

Workload

240 h

Teaching cycle

--

Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3 b)

Module appears in

Master's degree (1 major) Space Science and Technology (2015)
First state examination for the teaching degree Gymnasium Computer Science (2015)
Master's degree (1 major) Computer Science (2016)
Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computer Science (2017)
Master's degree (1 major) Satellite Technology (2018)

Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)

Module title				Abbreviation
Satellite Telecommunication Lab				10-I=STL-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Informatik (Computer Science)			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
6	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents
Completion of a project task (in Teams).
Intended learning outcomes
The project allows participants to work on a problem in computer science in teams.
Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2) + E (2) Module taught in: English
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 90 to 120 minutes) and field trip report (4 to 8 pages) or b) oral examination of one candidate each (approx. 20 minutes) and field trip report (4 to 8 pages) or c) oral examination in groups (groups of up to 3 candidates, approx. 15 minutes per candidate) and field trip report (4 to 8 pages) Language of assessment: English
Allocation of places
--
Additional information
--
Workload
180 h
Teaching cycle
--
Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module appears in
Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
Advanced On-Board Data Processing				10-I=ADP-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VIII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
6	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

On-board payload data processing encompasses the data acquisition, transfer, storage, data compression or reduction and transmission to ground of instrument and sensor data. Quite often the amount of raw data generated by modern instruments is in excess of what can be transmitted to ground. This makes it necessary to use various signal processing and compression techniques to reduce the amount of data. It is equally important to have high speed data links, large on-board storage capabilities and digital signal processors available that are fast enough handle data in the range of gigabytes per second.

Intended learning outcomes

The student learns how to use an on-board computer (OBC) that is reliable, usually with redundant processors and to enable this processing power for other applications which support the spacecraft bus, such as attitude control algorithms, thermal control, failure detection isolation and recovery.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

--

Additional information

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Workload

180 h

Teaching cycle

--

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
Modelling and Computational Science				10-M-MWR-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Mathematik (Mathematics)			Institute of Mathematics	
ECTS	**Method of grading**		**Only after succ. compl. of module(s)**	
8	numerical grade		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Aspects of mathematical modelling of technical or scientific processes. Basic principles of modelling, aspects of scaling the modelling, asymptotic series, classical methods for solving ordinary and partial differential equations, fundamental methods for numerical solution of partial differential equations and the resulting systems of linear equations.

Intended learning outcomes

The student masters the fundamental mathematical methods and techniques to simulate processes from natural and engineering sciences on a computer.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
Radar systems and missions				10-I=RSM-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science VII	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Introduction to the radar systems. Radar equation. Radar targets. Information from the radar signals. Fundamentals of coherent and incoherent radar systems. Configuration of the radar system and optimisation. Radar hardware incl. antennas, transmitter, receiver. Signal processing and data analysis. Radar systems applications for space research. This class introduces the student to the fundamentals of radar system engineering. The radar range equation in its many forms is developed and applied to different situations. Radar transmitters, antennas, and receivers are covered. The concepts of matched filtering, pulse compression, and the radar ambiguity function are introduced, and the fundamentals of radar target detection in a noise background are discussed. Target radar cross-section models are addressed, as well as the effects of the operating environment, including propagation and clutter. MTI and pulsed Doppler processing and performance are addressed. Range, angle, and Doppler resolution/accuracy, as well as fundamental tracking concepts, will also be discussed.

Intended learning outcomes

Student should have knowledge about physical principles, techniques and applications for radar systems.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title	Abbreviation
Advanced Programming	10-I=APR-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science II	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 to 120 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)
Master's degree (1 major) Information Systems (2019)

Module title				**Abbreviation**
Aerospace Seminar				10-I=SA-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Informatik (Computer Science)			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

Current topics in the area of aerospace.

Intended learning outcomes

The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (90 to 120 minutes) or
b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic)
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title			Abbreviation
Project Workshop			10-I=P1-182-m01

Module coordinator	Module offered by
Dean of Studies Informatik (Computer Science)	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

Completion of a project task (in Teams).

Intended learning outcomes

The project allows participants to work on a problem in computer science in teams.

Courses (type, number of weekly contact hours, language — if other than German)

R (6)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (project documentation (approx. 20 pages) with presentation (30 to 45 minutes) and subsequent discussion on the topic)
Language of assessment: English

Allocation of places

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Additional information

Additional information on module duration: block taught sessions project, duration 4 to 6 weeks.
Project in industriy or university in the field rover, planetary exploration, earth observation, tele communication.

Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title			Abbreviation
Selected Topics System Implementation			10-I=STSI-182-m01
Module coordinator			**Module offered by**
holder of the Chair of Computer Science VII			Institute of Computer Science
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	
Contents			
Selected topics in system implementation.			
Intended learning outcomes			
The students possess an advanced knowledge in the area of system implementation. They are able to understand solutions to complex problems in this area and to transfer them to related questions.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + Ü (2) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)			
a) written examination (approx. 90 to 120 minutes) or b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic) or c) oral examination of one candidate each (approx. 20 minutes) or d) oral examination in groups (groups of up to 2 candidates, approx. 15 minutes per candidate) Language of assessment: English creditable for bonus			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Satellite Technology (2018)			

Prototype Design & Implementation

(20 ECTS credits)

Module title			**Abbreviation**
Team Design Project			10-I=TDP-182-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science VIII		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Multi-disciplinary project in the area of aerospace that covers areas such as mechanical components, electronics and software. In this context, current and relevant topics from research are reviewed.

Intended learning outcomes

Students will practise reviewing complex topics in interdisciplinary teams. They will be required to plan, execute and check their work. At the end of the course, they will have created a completely functional system.

Courses (type, number of weekly contact hours, language — if other than German)

R (8)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (project documentation (approx. 20 pages) with presentation (30 to 45 minutes) and subsequent discussion on the topic)
Language of assessment: English

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
CanSat Design Lab				10-I=CDW-182-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science VIII			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
10	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

CanSat (now known as FloatSat) is an interdisciplinary project designed - not only - for SpaceMaster students. It is designed for students with different backgrounds, e. g. in computer science, electronics, mechanical engineering, aerospace technology, physics, mathematics. A satellite project is an interdisciplinary project that requires knowledge and skills in this as well as in numerous other fields. CanSat is thus an ideal platform to combine all available skills in a single project. It covers the design and development of the space segment control software and the ground segment control software: telemetry and telecommanding in wireless communication: space segment - ground segment, electrical subsystem (energy, batteries), mechanical construction.

Intended learning outcomes

The students are able to build and integrate into the inside of the sphere the power unit, a control computer, a payload (camera) and attitude control devices: Gyros and reaction wheel of a pico satellite. The software of a CanSat "satellite" includes a real-time operating system (provided by us), commanding (immediate and time-tagged commands), telemetry (real time and history data), attitude control, power control, payload control, image processing and radio links communication. The ground segment ought to be able to generate and send telecommands and to get and (graphically) display the telemetry.

Courses (type, number of weekly contact hours, language — if other than German)

R (8)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (development, construction and presentation of a "can sized satellite", project documentation (approx. 20 pages) with presentation (30 to 45 minutes) and subsequent discussion on the topic)
Language of assessment: English

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

--

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
FloatSat Design Lab				10-I=FDW-182-m01

Module coordinator	Module offered by
holder of the Chair of Computer Science VIII	Institute of Computer Science

ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

CanSat (now known as FloatSat) is an interdisciplinary project designed - not only - for SpaceMaster students. It is designed for students with different backgrounds, e. g. in computer science, electronics, mechanical engineering, aerospace technology, physics, mathematics. A satellite project is an interdisciplinary project that requires knowledge and skills in this as well as in numerous other fields. CanSat is thus an ideal platform to combine all available skills in a single project. It covers the design and development of the space segment control software and the ground segment control software: telemetry and telecommanding in wireless communication: space segment - ground segment, electrical subsystem (energy, batteries), mechanical construction.

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Courses (type, number of weekly contact hours, language — if other than German)

R (8)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (development, construction and presentation of a satellite control system, project documentation (approx. 20 pages) with presentation (30 to 45 minutes) and subsequent discussion on the topic)
Language of assessment: English

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

--

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

Module title				Abbreviation
International Summer School				10-I=ISS-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Informatik (Computer Science)			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

The summer school programme is for computer science students and students of aerospace technology-related study paths. The summer school addresses advanced students, Master's students and PhD candidates. The participants should be experienced in C/C++ and should have a good mathematical understanding. Part of the courses will be implementing a PID-control in C++. The lectures will include an introduction to information technology and devices in satellites, real time control systems, power supply in aeroplanes and satellites, control of quadrocopters, space systems, space environment, orbital mechanics and attitude control, satellite communication, and mission operations.

Intended learning outcomes

The participants will learn about spacecraft system design, the related hardware and software. This course consists of lectures and opportunities for practical application of the topics covered.

Courses (type, number of weekly contact hours, language — if other than German)

R (6)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 60 to 90 minutes) or
b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic) or
c) oral examination of one candidate each (approx. 20 minutes) or
d) oral examination in groups (groups of up to 3 candidates, approx. 15 minutes per candidate)
Language of assessment: English

Allocation of places

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Additional information

Additional information on module duration: block taught sessions project, duration 4 to 6 weeks.

Workload

150 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Satellite Technology (2018)

<table>
<tr><th colspan="5">Module title</th><th>Abbreviation</th></tr>
<tr><td colspan="5">Selected Topics Prototype Design and Implementation</td><td>10-I=STPDI-182-m01</td></tr>
<tr><th colspan="4">Module coordinator</th><th colspan="2">Module offered by</th></tr>
<tr><td colspan="4">holder of the Chair of Computer Science VII</td><td colspan="2">Institute of Computer Science</td></tr>
<tr><th>ECTS</th><th colspan="2">Method of grading</th><th colspan="3">Only after succ. compl. of module(s)</th></tr>
<tr><td>5</td><td colspan="2">numerical grade</td><td colspan="3">--</td></tr>
<tr><th colspan="2">Duration</th><th>Module level</th><th colspan="3">Other prerequisites</th></tr>
<tr><td colspan="2">1 semester</td><td>graduate</td><td colspan="3">--</td></tr>
<tr><th colspan="6">Contents</th></tr>
<tr><td colspan="6">Selected topics in prototype design und implementation.</td></tr>
<tr><th colspan="6">Intended learning outcomes</th></tr>
<tr><td colspan="6">The students possess an advanced knowledge in the area of prototype design and implementation. They are able to understand solutions to complex problems in this area and to transfer them to related questions.</td></tr>
<tr><th colspan="6">Courses (type, number of weekly contact hours, language — if other than German)</th></tr>
<tr><td colspan="6">V (2) + Ü (2)
Module taught in: English</td></tr>
<tr><th colspan="6">Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)</th></tr>
<tr><td colspan="6">a) written examination (approx. 90 to 120 minutes) or
b) project (project documentation approx. 20 pages with presentation 30 to 45 minutes and subsequent discussion on the topic) or
c) oral examination of one candidate each (approx. 20 minutes) or
d) oral examination in groups (groups of up to 2 candidates, approx. 15 minutes per candidate)
Language of assessment: English
creditable for bonus</td></tr>
<tr><th colspan="6">Allocation of places</th></tr>
<tr><td colspan="6">--</td></tr>
<tr><th colspan="6">Additional information</th></tr>
<tr><td colspan="6">--</td></tr>
<tr><th colspan="6">Workload</th></tr>
<tr><td colspan="6">150 h</td></tr>
<tr><th colspan="6">Teaching cycle</th></tr>
<tr><td colspan="6">--</td></tr>
<tr><th colspan="6">Referred to in LPO I (examination regulations for teaching-degree programmes)</th></tr>
<tr><td colspan="6">--</td></tr>
<tr><th colspan="6">Module appears in</th></tr>
<tr><td colspan="6">Master's degree (1 major) Satellite Technology (2018)</td></tr>
</table>

Thesis

(30 ECTS credits)

Module title				Abbreviation
Master’s Thesis SatTec Advanced Technology Systems				10-I=ThesisSatTec-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Informatik (Computer Science)			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
25	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		
Contents				
Independent research and work on a topic of satellite technology that was agreed upon with a lecturer.				
Intended learning outcomes				
The student is able to independently research a given subject in satellite technology and use the knowledge and methods that they acquired in the master courses. They are able to present the result of their work in an acceptable manner.				
Courses (type, number of weekly contact hours, language — if other than German)				
No courses assigned to module Module taught in: English				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				
Master's thesis (50 to 100 pages) Language of assessment: English				
Allocation of places				
--				
Additional information				
Time to complete: 6 months				
Workload				
750 h				
Teaching cycle				
--				
Referred to in LPO I (examination regulations for teaching-degree programmes)				
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Module appears in				
Master's degree (1 major) Satellite Technology (2018)				

Module title				Abbreviation
Oral Examination Space Science and Technology				10-I=DefSatTec-182-m01
Module coordinator			**Module offered by**	
Dean of Studies Informatik (Computer Science)			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	(not) successfully completed	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		
Contents				
Presentation and defence of the results of the Master's thesis in an open discussion and general question about SaTec topics.				
Intended learning outcomes				
The students are able to present the results of their Master's theses and defend them in a discussion.				
Courses (type, number of weekly contact hours, language — if other than German)				
K (0)				
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				
final colloquium (approx. 60 minutes) comprising: talk on thesis (45 minutes) and subsequent defence of thesis (15 minutes) Language of assessment: English				
Allocation of places				
--				
Additional information				
--				
Workload				
150 h				
Teaching cycle				
--				
Referred to in LPO I (examination regulations for teaching-degree programmes)				
--				
Module appears in				
Master's degree (1 major) Satellite Technology (2018)				