AGH
Offer for Student Mobility
DeSIRE^2 Project/ ERASMUS project students

Sponsoring unit:

AGH University of Science and Technology
Department of Automatics
Faculty of Electrical Engineering, Automatics, IT and Electronics
Mickiewicza Av.30
30-059 Krakow
Poland

AGH is ranked as one of the top Polish universities involved in engineering research and education. The University employs about two thousand faculty in 17 domain units, serving approximately 30 thousands students enrolled in undergraduate, postgraduate and continuing education programs. This project will be hosted by the Department of Automatics - a unit of the Electrical, Automatics, IT and Electronic Engineering Faculty. Main research activities of the faculty include modeling of complex nonlinear processes, development of algorithms and real-time software for control, distributed applications of industrial network technologies, embedded solutions using DSP/FPGA/FPAA, simulation and performance analysis of control systems, supervisory control methods (optimal control, predictive control, fuzzy control, neural control), and SCADA system applications. The Department of Automatics enrolls 200 graduate master and doctoral students in the area of Automatics and Robotics, with specializations in Automation of Industrial Processes, and Informatics in Control and Management using well equipped departmental teaching laboratories: Digital Control, Industrial Controllers, Microcontrollers and Digital Signal Processors, Robotics and Vision Systems.

Contact persons for project:

Professor Wojciech Grega (coordinator)
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woj104 (Skype)

Dr Adam Pilat
ap@ia.agh.edu.pl

Applicable graduate programs:

Masters of Science in Automatics and Robotics
Masters of Science in Applied Computer Science
Masters of Science in Electrical Engineering
Masters of Science in Telecommunication
Details of study

Credit system
The European Credit Transfer System (ECTS) is used at AGH to measure the actual workload of the students for a given course. A complete semester is equivalent to 30 ECTS, and the credits are allocated to the courses on a relative basis. The ECTS credits can only be obtained after successful completion of the required work and appropriate assessment of the course learning outcomes. 20 of the 30 credits can be thesis credits, given to a student who chooses to do a research thesis.
For DeSIRE mobility, the following equivalences will be applied: the AGH course including 30 or more hours (lectures, seminars, special topics project, supervised laboratory work, presentations of projects, examinations) will be “translated” to US 3 credits. 25 ECTS “thesis credits” will be translated to American 6 credits.

Grades at the AGH University

<table>
<thead>
<tr>
<th>Description</th>
<th>AGH grades</th>
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<tbody>
<tr>
<td>Excellent - outstanding performance with only minor errors</td>
<td>5</td>
</tr>
<tr>
<td>Very good - above the average standard but with some errors</td>
<td>4.5</td>
</tr>
<tr>
<td>Good - generally sound work with a number of notable errors</td>
<td>4</td>
</tr>
<tr>
<td>Satisfactory - fair but with significant shortcomings</td>
<td>3.5</td>
</tr>
<tr>
<td>Sufficient - performance meets the minimum criteria</td>
<td>3</td>
</tr>
<tr>
<td>Fail - considerable further work is required</td>
<td>2</td>
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</tbody>
</table>

The grade “6” can be used to reword special and outstanding achievements of the student.

Courses offered:

Summer 2009: Automatics and Robotics
<table>
<thead>
<tr>
<th>Lectures/laboratory</th>
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<tbody>
<tr>
<td>Intelligent Control Systems</td>
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<tr>
<td>Problem seminar (special topic research)</td>
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Summer 2009: Electrical Engineering
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<tr>
<td>Microcomputer systems in industry</td>
</tr>
<tr>
<td>Engineering programming in Visual C++</td>
</tr>
<tr>
<td>Signal processing algorithms</td>
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</tbody>
</table>
Numerical methods of electrical engineering 0/30

Summer 2009: Telecommunication

Distributed Network Environments 30/30

Winter 2009: Automatics and Robotics

Digital Control Algorithms 30/30
System Integration and Distributed Control 30/15
Problem laboratory (special topic project) 0/60
Image recognition and visual search 15/30
Signal Processing and Control with Field Programmable Analogue Arrays 15/30

Electrical Engineering

Control System Optimization 30/30
Computer methods of identification 30/30

Significant Dates:

16 February - 26 June - summer semester
16 February - 8 June - summer semester classes (15 weeks)
09 April - 15 April - summer holidays
01 May - 03 May - recreational break
08 or 15 May - Rector’s Day - Juwenalia
09 June - 26 June - summer examination session
27 June - 13 September - summer vacation, internships
14 September - 25 September - fall examination session

01 October 2009 - starts winter semester 2009

Erasmus Student Network
ESN at AGH University of Science and Technology supports exchange students before and during their exchange (not only Erasmus Students). In order to get more information please visit: www.esn.agh.edu.pl or contact:
- Magda Górsk (president) president.agh@esn.pl
- Mariusz Sołtyśik (vice president) soltysik@gmail.com
- Krzysztof Iwanek (ESN Travel coordinator) travel.agh@esn.pl
- Ula Dolska (Public Relations) pr.agh@esn.pl
- Piotr Żuchowicz (fundraising) sponsoring.agh@esn.pl

Arrival Airports:
Krakow – Balice International (KRK)

**Visa (US citizens)**

It is necessary to apply for a visa in a consulate if the planned period of stay in Poland is longer than 3 months. For details please contact the Polish Consulate in your country. Persons who have received a visa for the whole period of stay in Poland are not obliged to apply for a residence permit for their stay in Poland.

**Mentor – help on your stay**

A Mentor is a University student who can pick you up from the airport or the train station, take you around the city and the university and help you with the formalities upon your arrival. He/she can also provide you with assistance and advice during your stay in Krakow. Mentor’s assistance will be offered to you upon your acceptance to the AGH.

Contact:  [http://www.esn.org/](http://www.esn.org/)

**Accommodations**

The AGH Campus is located in a quiet part of the town surrounded by beautiful greenery. Several buses operate between the Campus and the city centre. The available facilities comprise: bank, supermarket, post office, football pitch, tennis courts, car park, student’s clubs and canteen. The Campus is guarded 24 hours a day. The cost amounts to 240 – 300 PLN monthly for one place.


Application (must be confirmed by the faculty Desire/Erasmus coordinator): miasteczko@agh.edu.pl, phone +48 12 617 34 71, +48 12 637 43 25

**Health and insurance**

**Students from EU member states** are advised to be insured in their home countries and bring a European Health Insurance Card which entitles them to the same treatment as Polish nationals.

**Non-EU students** are advised to purchase a health insurance policy in their own countries before arrival in Poland. Otherwise they will be asked to pay for any health service they get.

**Cost of Living in the Krakow area**

The cost of living in Krakow will depend on your life-style, needs and habits. The following approximate prices will give you an idea of the costs to expect:

- Accommodation – ca. 250 – 350 PLN /month (in a dormitory)
- Lunch in the student canteen: 7 - 12 PLN
- Dinner in the restaurant: 20 – 50 PLN
- Beer in the pub: 4 - 8 PLN
Municipal transport ticket – 1.5 – 2.5 PLN

Exchange rate: 1 USD = ca 2.6 LN, 1 Euro + ca 3.6 PLN

USEFUL LINKS

AGH Campus map:
http://www.dwz.agh.edu.pl/?p=118

AGH Department of International Relations:
http://www.dwz.agh.edu.pl/?p=90

Krakow on-line

Royal City of Krakow, capital of Poland till the 17th century, is now a city of culture and learning, with 13 institutions of higher education, numerous theatres, cinemas, museums, galleries, music centres and cabarets. In 1978 Krakow was placed on the UNESCO list of world heritage. It is located 219 m above the sea level, on the Vistula River, 100 km from the Tatra Mountains and 300 km from Warsaw. It is the fourth industrial city in Poland, with steel works, tobacco and pharmacological industry. The population is ca. 780,000. The climate is mild and continental.

Links:
http://www.cracowonline.com/
**Description of courses**

**Intelligent Control Systems**

**Semester:** Summer

# ECTS: 8  
Lectures: 45 hours  
Laboratory: 30 hours  
Department: Automatics  
Lecturer: Andrzej Turnau, Ph.D., professor

**Knowledge Prerequisites:** basis of control

**Assessment Method:** final written examination, laboratory exercises

**Aim:** General overview and practical laboratory survey of fundamental methods of intelligent control

**Syllabus**
Problem seminar (Special Topic Research) - *Summer*
Problem laboratory - *Winter*

**Semester:** Summer or Winter

**# ECTS:** 5 (4 – Winter)

**Laboratory:** 60 hours

**Department:** Automatics

**Responsible:** Adam Pilat, Ph.D.

**Knowledge Prerequisites:** basic of control and modelling

**Assessment Method:** laboratory exercises and project presentation

**Aim:** Practical modelling, simulation and control of laboratory test-rigs representing real industrial problems.

**Syllabus**
Modelling, simulation, identification, controller design and analysis of controlled mechatronics’ systems. Control in real-time: software and hardware support. Rapid prototyping. Hardware in the loop simulation. Practical implementations.
Available for experiments laboratory mechatronic test-rigs include: magnetic levitation, servo-drive with controlled torque, flexible beam, electromagnetic excitator.
Microcomputer Systems in Industry

Semester: Summer

# ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: 
Responsibility lecturer: Pawel Kwasnowski

Knowledge Prerequisites: basis of electronics and computer engineering

Assessment Method: final written examination, laboratory exercises

Syllabus
Engineering Programming In Visual C++

Semester: Summer

ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: Responsible: professor Jan Rusek Ph.D.

Knowledge Prerequisites: basic of computing

Assessment Method: laboratory exercises

Syllabus

Directive #include. Logical and bit-wise “and” and “or”. Defining single-argument operators.
Laboratory: Creating a Win32 Console Application program. Development of loops and i/o procedures. Creating a SDI application. Covering a CBitmapButton-objects with bitmaps. Using a ClassWizard to develop serving routines for Windows messages. Copying onscreen-drawn figures to a printer. Serialization of texts and figures. Use of CArchive to import data from file. Writing to bitmap in a compatible memory device context. Using a “rubber band” to indicate a to-be-zoomed rectangle. Serving clipboard in both the text and device independent bitmap format. Registering user’s clipboard format.
Signal Processing Algorithms

Semester: Summer

# ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: Responsible: prof. Tomasz Zieliński, Ph.D.

Knowledge Prerequisites:
Assessment Method: final written examination, laboratory exercises

Syllabus

Laboratory:
1. (N)LMS adaptive filters and their applications.
2. Least square estimation: direct and recursive method.
3. Time-frequency signal analysis: wavelet transform and filter banks.
4. High-resolution frequency estimation: Pisarenko and MUSIC algorithms.
7. LPC-10 speech compression algorithm.
8. Time delay estimation and echo detection. Signal cepstrum.
11. Image analysis (2-D FFT) and filtering. 2D-filter design.
Numerical Methods of Electrical Engineering

Semester: Summer

# ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: KANiUP

Responsible:
Knowledge Prerequisites: basic of computing

Assessment Method: laboratory exercises

Syllabus
Lectures: Lectures concern mathematical and computer modeling and simulation of dynamical linear and nonlinear systems, described by differential equations, both continuous and discrete time:
• processes and methods for model formulation, development and validation
• analysis and stability of dynamic systems
• comparisons of methods for numerical modeling and symbolic modeling
• uncertainties in modeling
• automation of modeling and software aid for modeling
• solving stiff and non-stiff differentials equations using different numerical integration methods
• dynamic models of electrical engineering systems

Laboratory: All laboratories will be conducted with the use of MATLAB/Simulink and MAPLE programs.
## Distributed Network Environments

<table>
<thead>
<tr>
<th>Semester:</th>
<th>Summer</th>
</tr>
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<tbody>
<tr>
<td># ECTS:</td>
<td>6</td>
</tr>
<tr>
<td>Lectures:</td>
<td>30 hours</td>
</tr>
<tr>
<td>Project:</td>
<td>30 hours</td>
</tr>
<tr>
<td>Department:</td>
<td>Telecommunication</td>
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<td>Responsible:</td>
<td>Piotr Pacyna, Ph.D.</td>
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</tbody>
</table>

**Knowledge Prerequisites:** Course on computer networks.

### Assessment Method:
Evaluation based on semestral work

### Aim
The aim of the course is to make student familiar with problems related to self-organization in distributed network environments including peer-to-peer and ad-hoc networks. Therefore autoconfiguration, management of uncertainty- and risk typical of distributed networked environments, building trust and resilience is studied in a systematic way.

### Syllabus
After many years of focus on fixed and centrally managed telecommunications systems new approaches to networking are being proposed. They are based on mobile, distributed solutions that often rely on spontaneous, voluntarily participation of users. In such a network environment, computing paradigms and network usage patterns are quite different from the well known, because the infrastructure is unavailable and often of no concern to the users. It is envisioned that in the future numerous systems will be designed to support spontaneous communications either in addition to the managed mode, or as a default one, and that the services designed specifically for this environment will receive more attention. The course aims to show and discuss directions for development of peer-to-peer and ad-hoc communications. We will discuss the properties of distributed environments, difficulties to create and maintain services, and the expected benefits.
System Integration and Distributed Control

Semester: Winter

# ECTS: 7
Lectures: 30 hours
Laboratory: 30 hours
Department: Automatics
Lecturer: professor Wojciech Grega, PhD/ Krzysztof Kolek, PhD

Knowledge Prerequisites: basis of control

Assessment Method: final written examination, laboratory exercises

Aim: General overview, theory and practical applications of teleinformatic technologies and integration methods developed for complex control systems.

Syllabus
Distributed and centralized control systems. Industrial fieldbuses. Description of the selected transmission protocols (wired and wireless) for control systems. Hardware and software solutions. Network access models. Modelling of the distributed control systems. Influence of network delays and data loss on control quality. Distributed control algorithms.
Digital Control Algorithms

Semester: Winter

# ECTS: 7
Lectures: 30 hours
Classes: 30 hours
Department: Automatics
Lecturer: professor Wojciech Grega, PhD professor

Knowledge Prerequisites: basis of control

Assessment Method: final written examination, laboratory exercises

Aim: General overview, theory and practical applications of computer-controlled systems.

Syllabus
Control systems optimization

Semester: Winter

# ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: KANiUP
Responsible:
Knowledge Prerequisites: basic of control

Assessment Method: final written examination, laboratory exercises

Syllabus
The subject of the lecture is optimization of finite dimensional system. Optimization of continuous and discrete time systems is discussed.

The lecture introduces the following issues:
• Linear Quadratic problems,
• Maximum Principle,
• Parametric optimization of PID controllers,
• Discretization of continuous time controllers,
• Nonlinear programming,
• Robus control,
• Introducing to nonlinear control,
• Optimization in artificial intelligence.

Additionally the problems of quantization effects in digital control systems, saturations of controllers and examples of practical realization of control laws are presented.
Laboratory experiments in MATLAB-SIMULINK software are undertaken and supplied with real time control systems presentation.
Computer methods of identification

Semester: Winter

# ECTS: 5
Lectures: 30 hours
Laboratory: 30 hours
Department: KANiUP
Responsible: prof. Janusz Gajda, PhD

Knowledge Prerequisites:

Assessment Method: final written examination, laboratory exercises

Syllabus
Basic notions, stages of identification process, identification process and measurement, structure of identification process, parametric and nonparametric identification, deterministic and stochastic identification problems. • Overview of the stochastic identification methods. • Model quality criteria, unbiased and effective estimators, covariance matrix. • Information matrix and lower variance bound of estimators in different identification problems. • Model measurability matrix, estimation and interpretation of the elements of measurability matrix. • Measurability criteria, their geometric interpretation, examples of measurability analysis. • Optimization of the identification process. • Model measurability vs. error and uncertainty of measurement. • Experiment design.
IS18 Image recognition and visual search
(selective course)

Semester: Winter

# ECTS: 2
Lectures: 15 hours
Project: 30 hours
Department: Automatics
Line of study: Applied Computer Science
Lecturer: Pawel Rotter, Ph.D.

Knowledge Prerequisites: Mathematical basis (basis of linear algebra, integration), basis of neural networks

Assessment Method: project presentation

Aim: Overview of methods and applications of image recognition and visual search

Syllabus
Applications of image recognition and visual search.

methods for control and identification of mechatronics systems. Rapid prototyping.
Signal Processing and Control with Field Programmable Analogue Arrays  
(selective course)  
Semester: Winter  

# ECTS: 2  
Lectures: 15 hours  
Project: 30 hours  
Department: Automatics  
Lecturer: Adam Pilat, Ph.D.  

Knowledge Prerequisites: basic signal processing, basic control, programming  

Assessment Method: project presentation  

Aim: Practical implementation of signal processing and control in programmable analogue devices.  

Syllabus  
Theory of programmable analogue devices based on switched capacitors technology with an application to the signal processing and control applications. The practical exercises including design, programming and dynamical reconfiguration form host PC and microcontroller. The designed signal processing path is tested and diagnosed. Practical implementation methods of filters and controllers. Features and limitations of a dedicated hardware and signal processing.