

## DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Automatika ir valdymas</i>
Valstybinis kodas	61201T102 (612H66001)
Studijų sritis	technologiniai mokslai
Studijų kryptis	elektros inžinerija
Studijų programos rūšis	universitetinės studijos
Studijų pakopa	pirmoji
Studijų forma (trukmė metais)	nuolatinė (4), iššęstinė (6)
Studijų programos apimtis kreditais <sup>1</sup>	160
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	elektros inžinerijos bakalauras
Studijų programos įregistravimo data	1997 m. gegužės 19 d. Perregistruota 2001 rugpjūčio 2 d.

<sup>1</sup> – vienas kreditas laikomas lygiu 40 studento darbo valandų

## INFORMATION ON EVALUATED STUDY PROGRAMME

Name of the study programme	<i>Automation and control</i>
State code	61201T102 (612H66001)
Study area	technological science
Study field	electrical engineering
Kind of the study programme	university studies
Level of studies	First
Study mode (length in years)	full-time (4), part-time (6)
Scope of the study programme in national credits <sup>1</sup>	160
Degree and (or) professional qualifications awarded	bachelor of Electrical Engineering
Date of registration of the study programme	19 May 1997

<sup>1</sup> – one credit is equal to 40 hours of student work

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## I. INTRODUCTION

This assessment report is based on the on Self-Assessment Report 2010 and other self assessment materials provided by the Kaunas University of Technology (KUT) for the Bachelor Study (BA) programme „*Automation and Control*“ and evidence material collected during on-site visit by experts of the international evaluation team. The responsibility of this study programme is with the Faculty of Electrical and Control Engineering. The remote study of the self-assessment documents was carried out in September/October 2010. The on-site evaluation was performed by the entire evaluation team on November 9, 2010 on the premises of KUT.

### Tuesday, 9 November

09.30 – 10.15	Meeting with Faculty administration staff
10.15 – 11.15	Meeting with staff responsible for preparation of Self-Assessment Report (SAR)
11.15 – 11.30	<i>Break</i>
11.30 – 12.30	Meeting with teaching staff
12.30 – 13.30	Meeting with students (large room for bachelor students)
13.30 – 14.30	<i>Lunch</i>
14.30 – 15.30	Visiting auditoriums, libraries, other facilities (studios, teaching rooms, computer services, etc.)
15.30 – 16.15	Familiarization with students' course and final papers (thesis), examination material
16.15 – 17.00	Meeting with alumni and employers
17.00 – 17.15	Experts private discussions and finalisation of the visit
17.15 – 17.30	Introduction of general remarks of the visit to the university

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All decisions concerning the final evaluation report have been taken unanimously by the entire team.

The following abbreviations are used in this report:

SER - Self-evaluation report

MA - Master

BA - Bachelor

## **II. PROGRAMME ANALYSIS**

### **1. Programme aims and learning outcomes**

#### **1.1. Programme demand, purpose and aims**

The *Automation and Control* BA programme at KUT is composed to prepare the first cycle specialists in the field of automation and control. The graduates should be able to continue studies in the second cycle as well as to work as qualified professionals in the industry. Because of the fast development of Lithuanian industry there is a high demand of specialists in the field of automation. The employers are mostly satisfied with the BA and MA programmes in the field of Automation and Control, but they prefer a solid knowledge in core subject areas, whereas a large number of specializations is not interesting for them. The programme *Automation and Control* is relatively popular among student applicants (third after informatics and civil engineering in KUT), but the number of admitted students during last years is decreasing. As a positive aspect, it could be mentioned that the coordination of the study programmes between several Lithuanian universities in the field of automation and control is existing. Due to the decreasing number of students and insufficient financial resources the activities could have more precise focus in the determined areas and the number of specializations could be reduced.

The purpose of the Automation and Control programme is to provide fundamental university level engineering education. The programme is fully compliant with the University mission and development strategy of KUT. The composition of the programme is based on EU directives, the state law and KUT leading documents. The programme coincides with the requirements of Lisbon strategy and Bologna declaration.

The aims of the programme correspond to general requirements of engineering studies: to provide theoretical fundamentals of business, management, humanitarian, social sciences, electrical engineering, mechatronics, automation and control and to develop practical skills in these fields. The programme aims are relevant to the purpose of the programme: to prepare engineers to be employed in different fields of industry and to aspire the second cycle studies in university. The aims of the programme are also compliant with the requirements to the BA cycle of the engineering studies. The on-site visit gave the evidence that students are satisfied with the study aims of the programme.

#### **1.2. Learning outcomes of the programme**

The study outcomes are clearly formulated in four groups: knowledge, intellectual abilities, practical skills and general transferable abilities and skills. The programme outcomes are

comparable with similar European programmes and in principle correspond to the programme aims. The programme outcomes include outcomes for all four specializations in the field of *Automation and Control*: mechatronic systems, process control, transport automation and control systems. Complexity level of the learning outcomes corresponds to qualification requirements described in national and EU documents. The outcomes are achievable during the study period.

Learning outcomes of the programme level correspond to the programme requirements. Learning outcomes of the programme are in good correlation with those of the subject level. The links between programme learning outcomes and study subjects are clearly defined by summary matrix presented in SER and are evaluated by experts as consistent in principal. Some general transferable abilities and skills like skills to communicate effectively (D1) or abilities to use legal and standard documents (D2) could be presented in more subjects, not only in language study, fundamentals of law or fundamentals of management.

The learning outcomes were updated in 2006 according to the comments made by accreditation experts. Mainly they have asked to clarify needs for the special knowledge and skills of specialists from industry partners and relate study subjects with learning outcomes in order to make clear vision of the programme.

## **2. Curriculum design**

### **2.1. Programme structure**

The study volume of the programme is 4 years for full-time studies and 6 years for part-time studies. The programme volume, 160 national credits, corresponds to the 240 ECTS credits. One national credit corresponds to the 40-hour student workload, including individual self-studies. The volume of studies fulfils the minimum requirements to the volume of BA studies according to the Lithuanian law of the higher education and average bachelor study volume in EU. The legal requirements for University first level study programmes have changed in June 2010. It has been stated during the onsite visit that the required changes in the programme have been implemented and a new version of programme was elaborated. The Faculty budget (1.5 MLitas = 0.43 M€) is too small for effective university activities in the wide area of specializations. The programme *Automation and Control* consist four specializations: 1) *Mechatronic systems*, 2) *Process control*, 3) *Transport automation* and 4) *Control systems*. The budget covers only minimum salary requirements for teaching staff but it is insufficient for adequate mobility and research activities. Urgent need for research funding exists and more activities for research project applications are needed.

Study subjects are in acceptable relation and sequence. The ratio of obligatory, alternative and elective subjects meets the Lithuanian state requirements and allows achievement of learning outcomes. The volume of general university studies is 12 credits that correspond to the minimum requirements 10-12 credits. The programme consists of specialization subjects in four elective groups: mechatronic systems, process control, transportation automation and control systems. One of these, transport automation subjects group, includes elective subjects (choice 1/2 or 4 credits from 8). The volume of free choice (optional) subjects is 8 credits. The volume of study field subjects and their consistency with the programme's aims are adequate.

## **2.2. Programme content**

Based on the SER and the interviews during the onsite visit it can be stated that the programme content is in good compliance with general requirements for such study programmes.

The sequence of subjects and internal links between different subjects are clearly formulated and corresponds to the programme needs. Themes delivered in the subjects correspond to the need of the BA programme. Modern teaching methods like software based simulators as well as virtual process control environment and learning by doing are used in classes. The programme consists of four specializations in the field of *Automation and Control*: mechatronic systems, process control, transport automation and control systems. There are also too many different study subjects, because of relatively small volume (2...4 credits) of subjects, that is hard to realize in the conditions of the too low study budget. The rationality of the programme should be enhanced.

## **3. Staff**

### **3.1. Staff composition and turnover**

In the *Automation and Control* programme 76 lecturers are involved; 68 of them (89 %) are full-time lecturers. Invited lecturers are used for teaching specific areas, e.g. transport automation. Too many specializations in the BA and MA programmes with small number of students in several courses is one of the reasons of high workload of teachers. The high teaching load (up to 1000 h/year) is the partial reason for the insufficient research activities of the teaching staff. The small number of doctoral students is the second reason for the low research activities of the teaching staff. Qualification of teachers (9 full professors, 41 associate professors, 10 lecturers and 16 others) corresponds to the needs of the programme. 25 of them

have professional and pedagogical experience of more than 30 years. The number of technical staff could be increased.

The main reason of teachers' turnover is the influence of doctoral students on the study process. The number of PhD annual graduates in the field of electrical engineering (including field of automation and control) during last years varies according to KTU web site in the range 5-11. In comparison with the number of teaching staff the number of doctoral students should be increased.

### **3.2. Staff competence**

Teachers' research activities, assessed on the basis of the publication list included in CVs, are in correlation with the study programme. Lecturers of the Department of Control Technologies and Department of Process Control publish annually on the average 57 papers; 14 of these having status ISI web of Science and 13 having status ISI web of proceedings. Teaching staff is working in close contact with industry. Their expertise and organizational activities have a positive impact on the study quality, because many industrial companies have supported university laboratories with industrial equipment and software. The programme coordinator (Head of the Department of Control Technologies), Assoc. Prof. V. Bagdonas, has 39 years of teaching experience.

Professional development of the lecturers in teaching, research and practical activities is regulated by the Rules of qualification development approved in KUT (January 2005). The professional development of teachers in different international firms and companies has positive influence on the study quality and cooperation between university and industry. The study process is supported by real industrial experience, equipment and software. During the last evaluation period seven doctoral students defended their dissertations. Some other professional development forms like post-doctoral practice in foreign universities or exchange of teachers between European universities mentioned in the SER, teachers' mobility and research activities should be used more intensively, because according to SER only two full time teachers have visited foreign university. The international mobility and research is the main character of modern high level science oriented university.

## **4. Facilities and learning resources**

### **4.1. Facilities**

Kaunas University of Technology has sufficient number of premises: classrooms in compliance with hygiene and work safety norms and equipped with modern audio and video appliances and laboratories. Study process is organized according to the classroom occupancy norms approved by the rules for *general university studies* and *subjects of study field lectures* – 100, practical training lessons – 25, laboratory works – 12 students; for *special subjects of study field* correspondingly 50, 20, 12. Good conditions for individual studies of the students are created at the University Central and Faculty libraries that have sufficient working places. The literature in the libraries is sufficient for first cycle studies in the field of Automation and Control.

The laboratory equipment is suitable and sufficient for studies. Laboratories are equipped with modern technological devices and software from well known industrial companies (e.g. SIEMENS, Schneider Electric, FESTO, Allen Bradley, Wonderware, Phoenix Contact, EW Eurodrive, Lenze, Omron, Danfoss etc) for different specializations of the study programme. Substantial support from the industry is closely correlated with teaching staff initiatives and its good contacts with the industry. The Faculty of *Electrical and Control Engineering* possesses three computer classes (in total of 48 workplaces) the hardware and software of which are renewed annually. The classrooms were renewed in 2007. For the specific calculations students can use software packages for scientific calculations such as Mathematica, MatCAD, MathLab and Statistica. For the electric circuit drawing the Autodesk AutoCAD, Centaurus and ElecWorkbech packages have been installed.

The practical training resources are suitable and accessible for students and are in compliance with the aims of the studies. The places of practice proposed by the departments are announced for students together with the recommendations to take individual initiative to search for the place of practice. For the formal start of practice, individual trilateral contracts are always signed between the University, the enterprise and the student. The eight week professional practice is carried out by the students during the months March-April, at the enterprises individually found or proposed by departments of *Process control* and *Control Technologies*. The activities of the enterprises for practice are mainly in the automation sector which is in compliance with the programme aims and learning outcomes.



## 4.2. Learning resources

The funds (resources) of the university library are accumulated according to the study programmes, branches and research fields. The most important methodical materials and books for the study programme have been written by faculty lecturers and are available in the Lithuanian language. All the printed matters are accumulated in open funds. Most of the periodical publications are available in electronic form. According to the SER the major part of the fund consists of literature in the field of engineering and technology - 69 %, mathematics and physical sciences 15 %, social sciences - 9 %. The number of publications corresponds to the study programme aims and learning outcomes (textbooks, books, scientific journal, etc.). The number of provided books and periodic publications is sufficient to conduct successfully the BA programme *Automation and Control*.

Learning materials, incl. methodological publications, are suitable and accessible for students. Students can use the methodological material: slides, lecture notes, methodological guides etc. The access to methodological materials is ensured by providing printed publications, via e-mail or Internet. Students and teachers are using the common e-mail address to which the lecturer of a study module places the necessary information for students, individual tasks, and other methodological information. This enables the student to get individual consultations via e-mail. Some methodological means (special mathematical modelling software) is worked out by faculty lecturers.

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## 5. Study process and student assessment

### 5.1. Student admission

Admission to the first cycle of the study programme conducted at the Faculty of *Electrical and Control Engineering* is realized according to general statements of the Rules of admission to the first cycle studies at Lithuanian Higher Education Institutions approved by the president of the Association of Lithuanian Higher Education Institutions for organization of common admission. Quite a wide range of the applicant's competition grades shows that this program is chosen by students with different basic level of competence. Therefore, a high amount of students do not complete the studies and the dropout rate is high. There are no special requirements for the basic student's knowledge level of the applicants that could be rational in the case of relatively low competition rate for the admission of first cycle students. In the case of higher competition rate the special requirements could be rational.

Coordinators of the programme (*Departments of the Process Control and Control Technologies*) participate in the admission process and organize the Open Days. Lecturers motivate the future students, introduce facilities of studies and research, and projects which are carried out in the departments. Educational activities are carried out in schools, in which the employers of the departments present the study programme. A promotional material about the programme has been designed and published. More motivated graduates in *Automation and Control* BA programme have been admitted after the education reform in 2009. Although the number of accepted graduates has decreased, the number of students that do not finish the studies (according to SER) has gradually decreased from 50% to 7%.

## 5.2. Study process

The programme schedule is organized in a rational way. The studies are organized in the autumn and spring semesters of 16 week duration according to the academic calendar placed in the university web site and printed publication of study programmes and in agreement with individual study plans and schedules. The morning hours are reserved for the theoretical lectures. The lectures are organized in such way that after two hours of theoretical lectures there is the workshop (practice, seminars or other) or break (lunch time). The schedule of the new semester is prepared in the middle of the current semester. First of all the theoretical lectures are planned and then the workshops. The semester schedule, which is approved by the dean and lecturers, is published on the information board and in the Internet site at the Faculty no later than one week before the beginning of the semester. The schedule can be corrected in accordance with the students needs during a week until the beginning of the semester. The exam schedule is approved by the dean and it is published two weeks before the exam session. The exam schedule is prepared by the vice-dean 1.5 months before the end of the semester.

Based on the analysis of the data on the numbers of admitted students and graduates during 2004 – 2009, it was found that the dropout rate reached up to 50 %. The high dropout rate is caused by the low admission requirements and the fact that there is no sufficient academic support for weaker students. The analysis of changes in student number indicates that the greatest dropout (40%) occurs during the first year of studies and especially during the first semester. The relatively high dropout rate is related to the lack of motivation and/or basic knowledge level of the admitted students. In the situation of decreasing number of students the department could focus its activities on a smaller number of specializations. The knowledge and skills of students have increased through self-education and informal ways. It implies participation in the projects; research students prepare their final degree projects and write

research papers. There are active and initiative students in the field of robotics. However, more support could be given to them, e.g. to found an IEEE student branch at KUT.

During the period under assessment, only two full-time teachers visited two foreign universities. The mobility of students during the period 2005-2010 was on the average four students per year (1...3 % from all students of the programme). Mobility of teachers and students is too small. Students do not receive sufficient encouragement by the teaching staff for mobility. No incentives for mobility and participation in conferences have been given to the teaching staff.

### 5.3. Student support

The majority of the dropped out students are with the lowest competition score at admission, mainly self-financed or partially state financed. During the last three years of their studies the students' number has been stabilized and dropout rate amounts only to 10%. The study process is being discussed with students. The regular weekly meetings are organized by the Dean's office with the heads of the BA groups and the tutors. To integrate the most talented students into the research activities, the specific tasks consistent with their abilities, are provided. There are active and initiative students in the field of robotics. More support could be given to them. In cooperation with employers lecturers of the Departments take active part in the event „*Career Days*” organized by the Career Centre of the University. The studying programme is personalized for students with freely selectable study subjects (8 credits in the first and second semester) and the alternative subjects (14 credits in sixth and seventh semester), but the programme with the elective and optional subjects could offer a study according to the individual study programme. The possibilities for students to repeat study subjects and to retake exams are defined in the university Rules of study subject results evaluation.

KUT has sports, health and cultural support facilities. From the University scholarship fund appointed to the Faculty by the Dean's order and with Student Union' state-financed students and those who have no academic failures, motivating scholarships for perfect results in studies and research up to four *basic social benefits* (hereinafter called BSB) are granted (1 BSB = 130 Lt = 37.3 €), 2 BSB motivating scholarship for good results in studies (for those who have entered the university before 2009-09-01) and up to 3 BSB motivating scholarship for distinctive activities in sports, culture, student projects and public activities. In an analogous way from the centralized part of the university scholarship fund under the offerings of the faculty dean three social scholarships equal to 3 BSB (until 2009 autumn) and motivating scholarship equal to 6 BSB = 224 € for exceptional results in studies and research are granted to the students by the

order of the Rector. The social scholarship is granted to a student who presents the documents proving his status as of a person to be socially supported. The students who are granted social scholarships have the possibility to be granted the regular or one time motivating scholarship and sponsor's scholarship as well. The need of dormitories for students of the programme is satisfied. The dormitories are competing more and more with rented residence premises in the private sector.

#### **5.4. Student achievement assessment**

For students' achievement assessment the ten grade criterion scale and cumulative motivating scheme through the whole semester is applied. The learning outcomes of each study subject in the study programme have been relevantly assessed. The assessment grade is the composition of homework, laboratory works, tests and exam grades. The assessment criteria are public.

Students are provided with the feedback on their achievements by familiarizing them within the assessment results of self-education tasks, written exams together giving oral comments by lecturers. The feedback on student achievements is effective, because it helps students to understand better how they learn the subject and how they can gain their experience and competence. The feedback from students to programme managers is confidential via Internet web site.

A general description of the requirements for final degree projects of BA and MA studies exists in KUT. Methodological guides for performing final degree projects are prepared by lecturers of the *Automation and Control* study programme. The lists of the students' final work themes and supervisors of the topics are approved by dean's order at the beginning of the semester. Final theses are defended at the meeting of *Automation and Control* study programme qualification committee appointed by the Order of the Rector. The qualification committee for awarding BA qualification degree in Electrical Engineering consists of high competence persons in the study field. During public defence of the thesis the student by his/her presentation, answers the given questions and remarks of the reviewer and thus should demonstrate acquired knowledge and skills. The assessment results of the final degree projects of regular and extramural mode students are in compliance with the mean grade of studies and quality of the final theses. The efficiency of final thesis assessment is difficult to evaluate as "good", because the number of members in the qualification committee is too big, especially in conditions when the Faculty budget is extremely intense.

According to the SER the students' motivation and their interests in the study field are the main factors that stimulate them to think beyond the study programme and autonomously gain of the knowledge and practical skills. This self-education process of the student is noticed by the lecturers, but there is no formal self-education assessment system.

### **5.5. Graduates placement**

There are good opportunities for the BA and MA graduates in the labour market. From the results of graduates questioning for the period under assessment it can be concluded that almost 50...60 % of the BA graduates are choosing MA studies. 20% of the graduates of part time studies from BA study cycle are choosing the MA study cycle. Job proposals from enterprises that require specialists of automation prove that modern labour market requires more specialists in the field of automation and control and confirm the validity and necessity of the study programme.

## **6. Programme management**

### **6.1. Programme administration**

The programme management is carried out by *Study Programme Committee* in accordance with the Statute of KUT. The study programme management and the quality assurance are supervised by the vice-rector for studies with the help of Studies Office and Studies Quality and Monitoring Office of the Academic Department. The *Study Programme Committee* cooperates with the departments and their coordinators of the programme. When the rational proposals on the study programme or the study subject contest are received from the students, lecturers or employers, these proposals are assessed in the department session and if necessary, necessary changes are made by the programme committee. The established programme management activities at KUT can be considered to be consistent and effective.

### **6.2. Internal quality assurance**

According to the SER, regular quality assessment of the programme is carried out in compliance with *system of internal quality assurance* of studies approved by the decision of the senate. Activities of the quality evaluation system are carried out in compliance to the approved normative documents. Periodicity of internal quality assurance of studies is based on the problematic results in quality assurance. According to the information about the study

programme assessment, the coordinators of the programme are taking measures for the elimination of identified shortcomings. Evaluation parameters, methods and aids are prepared by different groups of university members. The evaluation process is public. Participants are administration, staff members, students, employers and other stakeholders. Students, teachers and stakeholders are involved in the study programme quality evaluation and improvement. At the end of each semester the Study Programme Committee, the Faculty Council and students are seeking for feedback and evaluating the programme study subjects' and their teaching quality. For this purpose an electronic questionnaire is used in the university web site. Results of the questionnaires are discussed at the meetings of the dean's office and departments. Summarized statistics of the questionnaires are made public. The department lecturers of the study programme are participating in the programme assessment and quality enhancement activities at the department meetings.

Generally, in real situation the suitability of the programme quality evaluation and its improvement is problematic, because the process is inversely dependent of the aspiration of Department leaders to guarantee jobs for the teaching staff. The competition between different Departments inside the University to have more workload and therefore more finances exists. The situation should be changed on the University level.

According to the information about the study programme assessment in the SER, the coordinators of the programme are taking measures for the elimination of identified shortcomings. Taking in to account the conclusions, which were obtained after the assessment of the *Automation and Control* study programme in 2005 by the accreditation standard of the European engineering study programmes, the outcomes of the BA study programme and the study subject contest were adjusted. The updated content of study subjects is discussed and approved by the Study Programme Committee. According to the evidences from SER and based on the interviews during the onsite visit the efficiency of the programme quality improvement can be considered as consistent and rationally well justified.

Many external industrial partners are involved into the improvement of laboratory equipment (Lithuanian Railways, SIEMENS, FESTO, Klinkmann, Schneider Electric, JSC Phoenix Contact and others). Thanks to their support the laboratories of the study programmes are constantly modernized and expanded, the certificates are given for the basic laboratories, which allow developing of the training centre activities. Unfortunately general composition of the programme (many specializations, high number of small amount study subjects and therefore high workload of teachers) shows that economical (financial) efficiency of the study programme and management of available financial resources does not play a major role for most of the

teaching staff. The „cost-consciousness“ of the programme management should be seriously taken into consideration.

### **III. RECOMMENDATIONS**

3.1. As a positive aspect, it could be mentioned that the coordination of the study programmes between several Lithuanian universities in the field of automation and control exists. Due to the decreasing number of students and insufficient financial resources, it is recommended to focus the activities in more precisely determined areas. The number of specializations should be reduced for economical reasons. Therefore, smaller workload of teachers should give them better opportunities for research. The number of different subjects should be smaller and the volume of each study subject higher because of the simpler structure of the study programme and better correlation between different subjects.

3.2. Some professional development forms like post-doctor practice in foreign universities or exchange of teachers between universities should be used more intensively.

3.3. The existing proportions between teaching and research in the field of electrical engineering in KUT should be changed and more research activities and more research financing are needed.

3.4. The research and publication activities of the teaching staff should be intensified.

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#### IV. GENERAL ASSESSMENT

The study programme *Automation and control* (state code – 61201T102 (612H66001)) is given **positive** evaluation.

Table. *Study programme assessment in points by evaluation areas.*

No.	Evaluation area	Assessment in points*
1	Programme aims and learning outcomes	3
2	Curriculum design	3
3	Staff	3
4	Facilities and learning resources	4
5	Study process and student assessment (student admission, student support, student achievement assessment)	3
6	Programme management (programme administration, internal quality assurance)	3
	<b>Total:</b>	19

\*1 (unsatisfactory) - there are essential shortcomings that must be eliminated

2 (poor) - meets the established minimum requirements, needs improvement

3 (good) - the area develops systematically, has distinctive features

4 (very good) - the area is exceptionally good

Grupės vadovas:  
Team leader:

Prof. dr. Edmund Handschin



Grupės nariai:  
Team members:

Prof. dr. Kzysztof Kozlowski



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