UNIVERSITY OF PARDUBICE	
Directive No. 8/2023	
Subject:	Admission rules to the 1st year of doctoral study programme P0788D060002 Electrical Engineering and Informatics for the academic year of 2024/2025
Scope of authority:	Faculty of Electrical Engineering and Informatics and doctoral programme applicants
In effect from:	Date of issue
Elaborated and submitted by:	doc. Ing. Frantisek Dusek, CSc., Vice-Dean for Study Affairs
Approved by:	Ing. Zdenek Nemec, PhD., Dean

Dean of the Faculty of Electrical Engineering and Informatics of the University of Pardubice invites applicants for the entrance exam for the first year of Doctoral Programme for the academic year of 2024/2025 in accordance with the Article No. 48, 49, Act No. 111/1998 Coll. on higher education institutions and on the amendement and supplementto some other acts and sections 6, 7, 9 and 10 on the statuses of the University of Pardubice:
P0788D060002 Electrical Engineering and Informatics

Article 1
Application for studies

(1) Applications for study may be submitted electronically at http://eprihlaska.upce.cz or on a standard form (SEVT form) to the University of Pardubice, Faculty of Electrical Engineering and Informatics, Studentská 95, 532 10 Pardubice.

(2) The deadline for submitting applications for the academic year 2024/25, including payment of the administrative fee, is **17 May 2024**.

3) A copy of the proof of payment of the fee must be attached to the application on form SEVT. An application on Form SEVT without the enclosed proof of payment will be returned for completion. If the applicant fails to submit the document by the deadline, he/she has not fulfilled the admission requirement and the admission procedure will be terminated by resolution.

(4) It is not necessary to send a copy of the electronic application form (hereinafter referred to as the "e-application") by post, and it is not necessary to prove payment of the admissions fee (hereinafter referred to as the "fee") by using the correct payment symbols generated at the end of the e-application.

(5) In addition to the programme of study and the form of study, the application form must list the topic of the dissertation and the name of the supervisor. The list of topics is attached to this Directive.

(6) Applicants for the PhD study programme P0788D060002 Electrical Engineering and Informatics are obliged to send to the Study Department of the Faculty of Electrical Engineering and Informatics of the University of Pardubice the annexes to the application form in paper form, i.e. a structured CV in English, proof of the level of knowledge of the English language, officially certified proof of a previous master's degree and a copy of the passport (in the case of a foreign national applicant).

(7) Address for sending the application form and mandatory attachments:
University of Pardubice
Faculty of Electrical Engineering and Computer Science
Study Department
Studentská 95
532 10 Pardubice

(8) If the application for studies does not have the prescribed requirements or suffers from other defects, the applicant will be asked to remove them. If the applicant fails to remedy the defects within the time limit set, he/she will not meet the conditions for the opening of the admission procedure and the procedure will be terminated by resolution.

(9) On the basis of the registered application form, applicants will be invited in writing or electronically to take an entrance examination.

(10) A medical certificate is not required.

Article 2
Administrative fees

(1) Administrative fees for the procedure of admission in study programme in English P0788D060002 are:
Application fee: CZK 2000
University Account Name: Univerzita Pardubice
Account number: 37030561/0100
Variable symbol: 6921
Specific symbol: personal university number (generated by e-application)
Banks Name: Komercni banka Pardubice
Bank Address: nam. Republiky 222, 530 78 Pardubice
IBAN: CZ2901000000000037030561
SWIFT: KOMBCZPPPXX

(2) The fee for the admission procedure is non-refundable.

(3) Fee for the assessment of education in the admissions procedure in accordance with the Directive No. 11/2019 Rules for the assessment of foreign secondary and higher education within the admission procedure at the University of Pardubice:
Recognition fee: CZK 600
University Account Name: Univerzita Pardubice
Account number: 37030561/0100
Variable symbol: 6929
Specific symbol: personal university number (generated by e-application)
Banks Name: Komercni banka Pardubice
Bank Address: nam. Republiky 222, 530 78 Pardubice
IBAN: CZ2901000000000037030561
SWIFT: KOMBCZPPPXX

(4) The fee for the admission procedure is non-refundable.

Article 3
Conditions for admission to study

1) A candidate who successfully completes the study of a follow-up master's degree programme and successfully passes the entrance examination may be admitted to study. If the applicant does not have a certified copy of the diploma by the date of the entrance examination, he/she shall provide a confirmation of the date of the state final examination. The certified copy of the diploma shall be presented immediately after receipt of the diploma, at the latest at the time of enrolment.

2) Applicants for study at the university who have obtained their previous education elsewhere than in the Czech Republic or Slovak Republic are admitted to study in the Czech language under the same conditions as other applicants, provided that
a) their education has been recognised as the education required by law for admission to a doctoral programme
(b) they have complied with the conditions of the admission procedure laid down for other applicants

Applicants' higher education may be recognised for the purposes of the admission procedure in accordance with the Directive No. 11/2019 - Rules for the Assessment of Foreign Higher Education in the Admission Procedure at the University of Pardubice.

(3) Applicants for study at the University with citizenship other than that of the Czech Republic and the Slovak Republic shall be admitted to study in the Czech language under the same conditions as other applicants, provided that
(a) they have demonstrated, no later than on the date of enrolment, linguistic competence for study in a study programme in the Czech language
(b) they have complied with the conditions of the admission procedure laid down for other applicants.

Article 4
Admission procedure

(1) The regular date of the entrance examination is **25 June 2024**.

(2) A condition for admission to study in a doctoral study programme is proper completion of studies in a master's study programme and successful completion of the admission procedure, which includes:
-an oral examination in English,
-an oral professional examination according to the focus of the doctoral study programme.

The English language entrance exam assumes an entry level of B1+ SERR (formerly Intermediate). The exam will take the form of a motivational interview. The candidate will demonstrate the ability to communicate with some degree of independence in oral interaction in a personal and educational areas of language use, using relevant linguistic resources and structures. In terms of topics, the interview will focus primarily on previous study or work experience and motivation for further study and research in the chosen field in the doctoral programme. During the interview, the candidate will also be able to briefly inform about the chosen topic and the aims of his/her dissertation.

The professional examination requires professional knowledge at the level of a completed master's degree programme with a focus on the topic of the doctoral dissertation and the presentation of a thesis on the expected dissertation topic.

(3) In the case of foreign applicants, the Admissions Committee may determine the form and conditions of the entrance examination which do not require the personal presence of the applicant.

(4) If more than one applicant applies for the same doctoral dissertation topic, the committee shall determine the order of the applicants according to the result of the admission procedure. If the next applicants in order successfully pass the entrance examination, the committee shall offer them the unfilled topics or diversify the topic in agreement with the supervisor. In the event that no agreement is reached on the dissertation topic, the candidates will be selected in order of preference.

(5) Absence from the admission procedure will be the subject of a further hearing only if the applicant duly apologises and the faculty announces an alternative date for the admission procedure.

(6) In the event of a change in the form of study within the doctoral study programme Electrical Engineering and Informatics, the candidate will be admitted to the study outside the regular admission procedure and will have the examinations recognised in accordance with the Directive No. 8/2017 of the FEI UPa Rules for Recognition of Completed Courses.

Article 5
Method of deciding on admission

(1) A maximum of 7 applicants will be admitted to study in the order determined during the admission procedure.

(2) The admission decision will be issued within 30 days of the admission examination in accordance with the provisions of Section 50(4) of the Higher Education Act.

(3) The results of the admission procedure will be published on the publicly accessible www server of the University of Pardubice at https://www.upce.cz/studium/pro-uchazece/prijimacky.html. The publication of the results will respect the principles of personal data protection.

(4) The faculty delivers the decision to applicants for study itself or through a postal service provider. If the decision grants the applicant's application for admission to study, the decision may be delivered to the applicant via the University's electronic information system if the applicant has agreed to this method of delivery in advance in his/her application; in such a case, the date of delivery and notification of the decision shall be the first day following the date on which the decision is made available to the applicant in the University's electronic information system.

In Pardubice, 5th December, 2023

Ing. Zdenek Nemec, Ph.D.
Dean

Doctoral Thesis Topics 2024/2025

1.
Supervisor: prof. Ing. Pavel Bezoušek, CSc.
Supervisor - specialist: Ing. Jan Pidanič, Ph.D., *Jan.Pidanic@upce.cz*

Detection of weak radar targets on ground clutter background

The thesis subject is research on signal processing methods in radar, enhancing the detection quality of radar targets with low RCS and flat Doppler characteristics on the background of strong, unstable reflections from ground objects. Based on the literature study, the student will analyse the radar reflection characteristics of the selected objects and clutter and develop mathematical models of the reflected signals. The model outputs will be checked on the available data and compared with the results of other authors. Then he will design a signal processing model in Matlab, optimising the probability of detection of the selected objects, using, e.g., pre-detection tracking (TBD), PHD filtering, UKF or sequential Monte Carlo (S-MCM) tracking methods and micro-Doppler object characteristics. The results will be verified using the developed model of the reflected signals and the available real radar data.

2.
Supervisor: doc. Ing. Jan Mareš, Ph.D., *Jan.Mares@upce.cz*
Supervisor - specialist: prof. Ing. Roman Jašek, Ph.D.

Modern machine learning methods in biomedical data analysis

The aim of the dissertation is the design and implementation of a complex system for the analysis of biomedical data. Data for analysis will be provided/measured at the University Hospital of Královské Vinohrady Prague and the Hospital of the Pardubice Region. The system will (i) serve as an auxiliary tool for the specialist (MD) in the objective assessment of the patient's current condition, (ii) enable the analysis of one- and multi-dimensional data (mainly ECG, heart rate, movement data, possibly CT and NMR). The methodology used for the analysis will be based on classical statistical methods (OLR, RF, etc.) and will also use deep learning methods.

3.
Supervisor: doc. Mgr. Jiří Tuček, Ph.D., *Jiri.Tucek@upce.cz*
Supervisor - specialist: Mgr. Jaroslav Marek, Ph.D., doc. Mgr. Pavel Tuček, Ph.D.

Detection and parametrization of nanoparticles

Magnetic nanoparticles based on iron oxides still arouse great interest from the point of view of their basic and applied research. It is known that their physicochemical properties are controlled, among other things, by their size and shape, where quantum and surface phenomena arise. For modeling and predicting the properties of nanoparticle systems, knowledge of the distribution functions of the dimensions, rotations, and frequency distribution of nanoparticles in their ensemble is therefore very useful. These parameters make it possible to assess the appropriateness of the use of such systems and therefore to evaluate their application potential.
The aim of the dissertation thesis will be to create a methodology based on the image analysis of 2D images of microscopic images of nanoparticle systems. Detection will be based on methods for finding object edges. This will be followed by a non-linear regression analysis,

which will enable the detected nanoparticle to be parametrically described by an ellipse. This approximation will make it possible to estimate the distribution functions of nanoparticle dimensions and other characteristics of the entire nanoparticle system. The methodology will be accompanied by a critical mathematical-statistical analysis of the estimated characteristics. The theoretical models proposed and discussed in the work will then be critically evaluated by their application on selected suitable nanoparticle systems, mainly based on iron oxides. The solution to the problem also includes the subsequent computer algorithmization of the evaluation of the size statistical characteristics of nanoparticle sets with a certain degree of autonomy in the processing of their microscopic images.

4.

Supervisor: doc. Mgr. Pavel Tuček, Ph.D., *Pavel.Tucek@upce.cz*
Supervisor - specialist: Mgr. Jaroslav Marek, Ph.D.

Statistical acceptance and its connection to process regulation

Statistical acceptances are used to decide whether the deliveries of certain products from the supplier meet the requirements of the customer, who is interested in the quality of the delivery or the proportion of defective products in the delivery. This can also be freely used in the case where the role of customer and supplier is represented by individual downstream production processes. In each acceptance, acceptance quality control is carried out, which is divided into a hundred percent and selective according to the scope. The work will therefore be devoted to such methods of monitoring the quality of processes and ensuring the required characteristics of product quality and verifying their eligibility. First of all, the student will carry out a thorough research of the current methods used in the field of statistical quality acceptance with an emphasis on the methods of multiple selections. Furthermore, the student will propose new approaches for calculating the price aspects of the acquisition plan. After studying and designing new methods, it is expected that the author will create an application that will enable statistical control of the process, calculation of capability indices, calculation of Hotelling statistics for several characters, and construction of a loss function following the performed statistical acceptance. The student also includes the latest findings from the research conducted in the entire process. In the framework of the created application, the student will mainly evaluate the total cost of quality. Depending on the chosen application, a feedback system will also be designed to transmit detected errors in process parameters that could lead to correction. This procedure is conceptual and a detailed study of individual methods will be needed, including the design of some partial, completely new parts.

5.

Supervisor: doc. Mgr. Pavel Tuček, Ph.D., *Pavel.Tucek@upce.cz*
Supervisor - specialist: Mgr. Jaroslav Marek, Ph.D.

Statistical modeling of natural phenomena: Analysis of landslides

Regression analysis is a statistical method used to analyze the relationship between two or more variables. The main goal of this analysis is to understand how one or more independent variables affect the dependent variable and in what way. Slope slide modeling is a key element in geotechnical engineering to help predict and manage the risks associated with slope (land) slides. Regression analysis is one tool that is often used to create mathematical models that can predict the behavior of a slope and identify factors affecting its stability. Regression analysis focuses on identifying relationships between independent variables (e.g., geological composition, slope, precipitation) and a dependent variable (e.g., slope movement).

Using this analysis, we can reveal which factors have a significant influence on the slope slide and in what way. An important part of the regression analysis is also the determination of the statistical significance of the relationships found and the evaluation of the accuracy of the model. In this way, we can obtain reliable predictions for future landslide events. The student will work with landslide data sets in the village of Halenkovice, where the trainer has access to installed sensors and slope movement sensors. Today, this database has approx. 80 points and a 20-year history. The result of the student's work will be the design of regression models that reliably and rigorously analyze the relationships between individual quantities and parameters. These models will be used to model landslides in the places where the landslides have already been active and this will achieve an understanding of individual dependencies; it will also be possible to target-model the conditions under which landslides occur in locally threatened places and, last but not least, it will be possible to predict the future state of the given locations.

6.
Supervisor: doc. Ing. Dušan Kopecký, Ph.D., *Dusan.Kopecky@upce.cz*
Supervisor - specialist: Ing. Tomáš Zálabský, Ph.D.

Development of methodology and apparatus for measuring the shielding efficiency of flexible shields of electromagnetic interferences

Modern flexible shields of electromagnetic interferences (EMI) based on composites of polymeric materials and conductive fillers suffer from inhomogeneities and defects caused by mechanical fatigue of the material or due to its aging. Current standard methods used to evaluate the shielding efficiency of EMI shields have limited options for locating and evaluating these faults. The aim of this work is therefore to develop a new methodology and equipment for measuring and mapping the shielding efficiency of thin EMI shields based on organic substances. The work will develop a unique device using visualization of the distribution of the electromagnetic field in the near zone, including the methodology of measuring and interpreting the results. The device will also include newly developed software that will allow the visualization of scattering parameters and localization of faults and inhomogeneities. The result of the work will be an advanced method for the study of shielding efficiency, which can be applied in materials research and in the optimization of chemical, mechanical and electrical properties of EMI flexible shields. The work will take place in collaboration with the University of Chemistry and Technology in Prague.

7.
Supervisor: doc. Ing. Tomáš Brandejský, Dr., *Tomas.Brandejsky@upce.cz*

Development of continuous genetic programming algorithms

The goal of this PhD work is to outline and to develop original algorithm of continuous genetic programming for model identification (symbolic regression) of complex systems. The continuous genetic programming eliminates non-linearity (leap changes) in behaviors of developed models in classical algorithms of genetic programming. Thus (theoretically) after finishing of a such algorithm it should be more efficient, than standard algorithms of genetic programming and thus more suitable to modeling of complex systems described by data sets up to category „Big Data“. The goaů of this work is to verify this precondition. For testing of suggested algorithm the design of original implementation with application of parallel programming is expected as well as the verification on set of complex examples with use of computer cluster (supercomputer). On the base of this validation the work will be formulated.