Assistant professor for research
(PostDoc researcher in project funded by National Science Centre, Poland)
Department of Automation, Biomechanics and Mechatronics

Lodz University of Technology is one of the finest universities of technology in Poland. Its tradition and experience in training professionals and conducting research date back more than 75 years. It is an attractive partner for business. It cooperates with the largest national and international corporations. It conducts research of a European standard, develops new technologies and creates innovation in collaboration with the leading research centres all over the world. One of the pillars of Lodz University of Technology management is equal treatment of staff regardless of their gender, age, race or other demographic and social characteristics. In 2016, TUL was the first technical university in Poland to receive the HR EXCELLENCE IN RESEARCH award certifying that the University adheres to the principles of *the European Charter for Researchers* and *the Code of Conduct for the Recruitment of Researchers*.

1. The requirements to be met by the candidate

Formal requirements:

- PhD in one of the following: mechanics, applied physics, applied mathematics, computer physics obtained no earlier than 7 years;
- Do not have contract employment or will take an unpaid leave for the duration of employment in project;
- Do not receive any other form of remuneration from Polish National Science Centre;

Additional requirements:

- Fluent English language – allowing for communication and writing of research documents (obligatory);
- Confirmed publication of scientific papers related to modeling, dynamic analysis and/or synchronization of mechanical/dynamical systems in the scope indicated in the proposal;

- Knowledge in the field of:
  - deriving the equations of state dynamics in various mathematical representations;
  - programming numerical procedures in a script language and in a block form;
  - solving ordinary differential equations;
  - modeling of vibrating systems with a small and large number of degrees of freedom,
  - modeling and mathematical description of the phenomenon of resonance, synchronization, friction and time delays;
  - recording results and performing experimental measurements;
  - compiling research results and submitting publications to scientific journals

2. Specification of the terms and conditions of employment

- Full-time position
- Expected employment duration up to 12 months
- Expected date of employment: August 1, 2022

Note: starting date can change in case of the need for additional employment permissions.

Authority associated with the position.

- the possibility of developing a scientific career;
- participation in national and international conferences;
- publishing scientific articles in journals with a high citation index;

3. Description of the expected responsibilities and duties

- conducting research related to the subject of the project;
- documenting the results in the form of publications in renowned scientific journals.

4. List of the required documents

1) application for employment to the Rector of Lodz University of Technology;
2) personal questionnaire for a person applying for employment at Lodz University of Technology, as provided in Annex no. 1;
3) Data Privacy Statement as provided in Annex no. 2;
4) Consent to the processing of personal data, as provided in Annex no. 3;
5) true copies/copies of diplomas;
6) other documents proving the qualifications.

5. The place, manner, and deadline for submitting the documents

Applications should be sent in form of PDF files by email to Secretariat of Department of Automation, Biomechanics and Mechatronics w1K11@adm.p.lodz.pl by June 5, 2022. For easier identification please use the following notation in the topic of email **„OPUS18_PS_R22"**

6. Contact person

Magdalena Jastrzębska w1K11@adm.p.lodz.pl

7. The expected date of the announcement of the decision

30.06.2022

8. Information materials for the candidate:

This job offer concerns employment for PostDoc researcher position in the project funded by National Science Centre - OPUS 18: „Nonlinear vibrations of coupled self-excited oscillators with parametric/auto-parametric excitation and non-ideal energy sources". The main scope of project is as follows:

- Selecting and examining the properties of dry friction models in terms of adapting them to the description of self-excited vibrations in multi-body systems.
- Preparing a skeleton of basic numerical procedures for modeling dry friction in discontinuous dynamical systems.
- Carry out analysis of parametrically/auto-parametrically excited systems to check the potential operating regimes of such systems in terms of behavior synchronization, chaotic vibrations, resonances and stability loss.

Project description available in Annex no 4

PERSONAL INFORMATION FORM

FOR APPLICANTS FOR EMPLOYMENT AT LODZ UNIVERSITY OF TECHNOLOGY

1. First name(s) and family name .....

2. Date of birth .....

3. Contact detail .....

4. Education

name of school, field and graduation date + obtained occupation, specialisation, degree, professional title, academic title

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5. Professional qualifications:

courses, postgraduate education, other forms of further development of knowledge and skills

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6. Employment history:

employment periods and jobs held at previous employers'

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7. Additional personal information, where the right or the duty to disclose it exists under specific regulations

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(place and date) (signature of the applicant)

Data Privacy Statement for job candidates

Pursuant to Article 13(1) and (2) of Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (General Data Protection Regulation, Official Journal of the EU L 119/1), hereinafter referred to as "GDPR", we inform you as follows:

1) Lodz University of Technology with the registered office in Lodz is the Controller of your personal data;
2) We have appointed a Data Protection Officer to supervise the compliance of personal data processing, who can be contacted in matters concerning the protection of your personal data at the following e-mail address: rbi@adm.p.lodz.pl; telephone number: 42 631 2039; or in writing to the address of our registered office: Lodz University of Technology, Żeromskiego 116, 90-924 Łódź;
3) As the controller, we will process your data for the purpose of the recruitment process for the position indicated, based on your consent (Article 6(1)(a) GDPR);
4) You have the right to withdraw your consent to the processing of your personal data at any time, but such withdrawal shall not affect the lawfulness of the processing effected on the basis of your consent prior to its withdrawal;
5) You have the right to lodge an objection against the processing of the data as set out above at any time. We will cease to process your data for these purposes unless we can demonstrate that there are compelling legitimate grounds for us to do so which override your interests, rights, and freedoms, or that your data will be required for the possible establishment, assertion, or defense of claims;
6) Your personal data provided in the CV, personal information form for the applicant for employment, and copies of documents supporting your professional experience, education, additional credentials and qualifications will be processed for the period in which claims related to the recruitment process may arise, i.e. for 6 months following the conclusion of the recruitment process. For individuals who have given their consent to the processing of personal data for the purposes of future recruitment, for a period of 12 months following the conclusion of the recruitment process during which the consent has been given;
7) Only individuals authorized by the Controller to process your data in the performance of their duties will have access to your data;
8) Your personal data will not undergo automated processing and will not be subject to profiling;
9) Under GDPR, you shall further have:
   a) the right to access your data and to receive copies thereof,
   b) the right to rectification (amendment) of your data,
   c) the right to erasure/to be forgotten, restriction of data processing,
   d) the right to data portability,
   e) right to file a complaint to the supervisory authority - President of the Personal Data Protection Office, Stawki 2, 00-193 Warsaw.

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(date and signature of the candidate)

Consent of the candidate to the processing of personal data (pursuant to Article 7 GDPR)

I consent to the processing of my personal data by Lodz University of Technology, the Controller of the data included in the following documents that I have submitted:

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for the purpose of recruitment.

I hereby declare that I have been informed of the right to withdraw my consent at any time, effective as of the date of submission of the withdrawal of consent.

The Controller (or an authorised representative) has also informed me that the withdrawal of consent does not affect the lawfulness of the processing performed on the basis of the said consent prior to its withdrawal.

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(date and signature of the candidate)

Project description

The goal of the project is investigation of dynamical properties of mechanical systems exhibiting complex self-excited oscillations, that is supplied by a constant in time energy source or parametric oscillations, where an important role is played by certain system parameters variable in time. The dynamic properties of energy sources, such as various types of drives, including electric motors, e.g. DC, will also be taken into account in these tests.. The research concerns mechanical systems with a finite number of degrees of freedom and mechatronic systems, i.e. mechanical systems with advanced control, using elements of electronics and computer science. These types of systems may exhibit previously unknown bifurcation scenarios, i.e. changes in dynamics for slowly changing parameters, or these scenarios may be relevant from the point of view of applications in mechanical engineering or mechatronics. The project's objectives also relate to the detection, analysis and control of complex and potentially unknown physical processes and bifurcation dynamics of such systems, including complex resonances, parametric resonances, synchronization, regular and chaotic vibrations.
In frame of the project there are realized the following mutually connected tasks:
1) friction models and numerical solutions of parametric self-excited systems;
2) parametrically excited systems with ideal/nonideal sources of energy;
3) nonideal source and self-excited parametric oscillators with friction;
4) multi-degree-of-freedom self-excited parametric oscillators with friction;
5) parametric resonances;
6) friction induced self-excited oscillations of a double spatial pendulum;
7) bifurcations and synchronization of chains of translational-rotational stick-slip oscillators;
8) dry-friction-induced vibrations in single and in coupled mechanical oscillators;
9) mathematical modeling and numerical investigations of bifurcation dynamics in mechanical systems with belt drives and transporters;
10) physical pendulum forced by periodic torque-angle excitation.
Investigations concern dynamical systems occurring or modelling phenomena occurring in mechanical engineering and mechatronics. They involve the creation of a mathematical description of physical phenomena and special procedures allowing to obtain their numerical solution. In many cases, these models are then experimentally verified by estimating model parameters and matching the solution of model equations to experimental data, followed by model validation for other experimental data. The appropriate mathematical model then allows for better understanding and explanation of the observed phenomena or detection of previously unknown phenomena and then their experimental verification. During the project it is widely used the previous experience of the investigators, including studies and special mathematical models of systems with dry friction and impacts, real resistance to motion in bearings and magnetic interactions.
The topic of the project has been taken up due to its potential cognitive and purely scientific values. In such systems, dynamic phenomena previously unknown or poorly known may occur. Mathematical modeling and the methods of numerical solving the corresponding equations in many cases require special approaches. This applies especially to systems with dry friction and impacts. In addition, tested systems and dynamic phenomena can find potential equivalents and applications in industry. Knowledge of the bifurcation dynamics of a mechanical structure or mechatronic system allows them to be designed to avoid adverse effects. Knowledge of the mathematical model allows predicting the behavior of real systems in a much faster and cheaper way than using experimental research. The mathematical model enables fast and correct design of mechanical and mechatronic systems.
The most important expected outcomes of the project include fuller knowledge of dynamical phenomena occurring in parametric and self-excited mechanical and mechatronic systems, z with account of the energy source properties. The project will also result in original mathematical descriptions of this type of systems and corresponding numerical simulation methods.