name of the unit:

DEPARTMENT OF AUTOMATION, BIOMECHANICS AND MECHATRONICS

symbol:

K-11

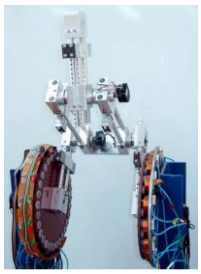
http://www.abm.p.lodz.pl

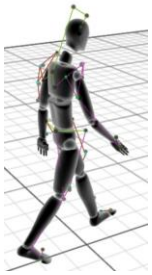
head of the unit:	potential promoters:	contact person:
Prof. Jan Awrejcewicz, PhD, Dsc	Grzegorz Kudra, PhD, DSc, TUL Prof. Paweł Olejnik, PhD, DSc, TUL Prof. Dariusz Grzelczyk, PhD, DSc	Grzegorz Kudra, PhD, DSc, TUL Prof. phone.: 42-631-23-39 grzegorz.kudra@p.lodz.pl

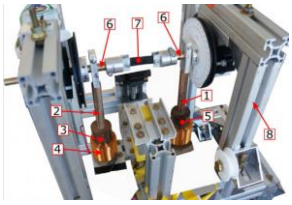
scope of activities:

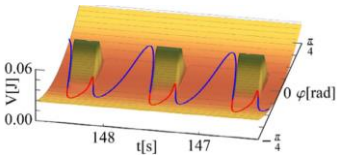
The main areas of interest and research directions are:

- nonlinear dynamics of mechanical and mechatronic systems
- mathematical modelling and identification of mechanical and mechatronic systems
- mechanical systems with dry friction and impacts
- multibody systems dynamics
- vibrations of plates and shells
- biomechanics (exosceletons, modelling and gait analysis)
- asymptotic techniques and symbolic computations
- numerical methods and algorithms
- control systems









present activities:

We conduct works concerning modelling, simulation, analytical and experimental studies of nonlinear dynamics of mechanical and mechatronic systems and system composed of nanoplates and nanoshells. We develop software that allows to predict, study and control bifurcation and chaotic phenomena occurring in such systems.

We investigate the dynamic properties of mechanical systems exhibiting complex self-excited vibrations or vibrations. In these tests, we take into account the properties of energy sources, such as various types of drives, including electric motors. We detect, study and control complex and potentially unknown physical processes and bifurcation dynamics, such as complex resonances, including parametric resonances, synchronization, regular and chaotic vibrations.

We conduct research on gait stability, geometric and kinematic analysis of limb motion. We use the Motion Capture system to study motion. We analyse the effectiveness of electromyography in identifying activity and controlling muscle groups. We develop and improve mathematical models of muscles and bones.

future activities:

Development and improvement of mathematical and numerical models and dynamics control systems of mechanical, mechatronic and biomechatronic systems.

The portfolio of research groups was created as part of the Programme "STER" – Internationalisation of doctoral schools" as part of the realization of the project "Curriculum for advanced doctoral education & taining – CADET Academy of Lodz University of Technology".

publications/patents, awards, projects:

- Polczyński, K., Skurativskyi, S., Bednarek, M., Awrejcewicz, J. (2021). Nonlinear oscillations of coupled pendulums subjected to an external magnetic stimulus. *Mechanical Systems and Signal Processing, 154, 107560.*
- -Awrejcewicz, J., Kudra, G. (2019). Rolling resistance modelling in the Celtic stone dynamics. Multibody System Dynamics, 45(2), 155-167
- Witkowski, K., Kudra, G., Skurativskyi, S., Wasilewski, G., Awrejcewicz, J. (2021. Modelling and dynamics analysis of a forced two-degree-of-freedom mechanical oscillator with magnetic springs. *Mechanical Systems and Signal Processing,* 148, 107138**.**

We conduct the following research projects:

- " Modelling and nonlinear dynamics of magneto-electro-mechanical systems ", National Science Centre, competition OPUS 14, 2017/27/B/ST8/01330.
- "Nonlinear vibrations of combined self-excited oscillators with parametric/auto-parametric excitation and non-ideal

keywords:

nonlinear dynamics, bifurcations, chaos, gait stability, plates and shells, dry friction, impacts, mathematical modelling, identification, synchronization, non-ideal energy sources, energy harvesting

list of internship proposal in this research team:

- Postdoctoral fellowships and fellowships for doctoral students and second-cycle students in grants related to the following works: experimental investigations, development of mathematical and simulation models, identification and study of dynamic phenomena in mechanical, mechatronic and biomechanical systems.