Tematyki i zakresy rozpraw doktorskich z dyscypliny naukowej inżynieria mechaniczna oferowane kandydatom do Szkoły Doktorskiej Politechniki Białostockiej w roku akademickim 2023/2024

Lp.	Tytuł, stopień naukowy, imię i nazwisko ewentualnego promotora/ów	Tematyka	Zakres	Tel. służbowy	e-mail
1.	prof. dr hab. Oleksandr Jewtuszenko	Influence of the temperature of the real contact area (the flash temperature) on the maximum temperature of the friction elements in a braking system.	1. Critical literature review of mathematical modeling and experimental measurements of the flash temperature. Establishment of the research gap. 2. Familiarization with experimental methods for determining the roughness parameters of friction surfaces. 3. Selection of a mathematical model to determine the flash temperature with consideration of the temperature dependence on the mechanical and thermophysical properties of the friction materials. 4. Performance of numerical analysis for selected friction pairs, brake types and braking mode. Comparison of the obtained results with experimental data known in the literature. 5. Implementation of the developed methodology for determining the flash temperature to the system of equations of heat dynamics of friction (SEHDF) during braking. 6. Determination of the maximum temperature of the friction elements in a braking system based on the numerical solution of the SEHDF. 7. Development of final conclusions and recommendations.	571 443 028	a.yevtushenko@pb.edu.pl
2.	Prof. Dr. Roman Kulchytskyy	Selected axisymmetrical contact problems of thermoelasticity for a bodies with gradient coating	1. Review of the literature on the theory of elasticity and thermoelasticity for a bodies with gradient coating. 2. Mastering the theory of integral transformations as a method for solving boundary problems, especially the Hankel integral transformation method. 3. 3 Formulation of axisymmetrical contact problems of thermoelasticity with heat generation for gradient coating bodies. 4. Description a solution scheme for the formulated problems. Obtaining integral equations 5. Mastering the methods of numerical solution of integral equations. Numerical analysis of the influence of input parameters on the basic contact characteristics and stress distribution. 6. Conclusions.	571 443 030	r.kulczycki@pb.edu.pl

3.	prof. dr hab. inż. Krzysztof Kurzydłowski	Design and experimental validation of metamaterials obtained by 3D printing with special mechanical properties.	1. Literature review focused on properties of metamaterials 2. Design of light weight metamaterials obtained by 3D printing and specific mechanical properties 3. Development of software for printing the designed structures 4. Testing of mechanical properties of printed structures 5. Analysis of the results in the context of rules of designing metamaterials with specific properties 6. Summary and conclusions	571 443 056	k.kurzydlowski@pb.edu.pl
4.	prof. dr hab. inż. Krzysztof Kurzydłowski	Bioreactors for cultivation of algae with improved functional properties and in-service time	1. Literature review focused on properties of materials used for bioreactors 2. Selection of materials for new type of bioreactor with inside lighting 3. Preparation of a model reactor 4. Experimental validation of the new reactor 5. Analysis of the results 6. Summary and conclusions	571 443 056	k.kurzydlowski@pb.edu.pl
5.	prof. dr hab. inż. Krzysztof Kurzydłowski	Thermoplastic starch and its modifications increasing applicability for production of single use products	1. Literature review focused on applicatioins of modified starch 2. Selection of bio-modifiers materials and mineral additives increasing toughness and reducing water intake 3. Selection of materials for new type of bioreactor with inside lighting 4. Preparation of a model reactor 5. Preparation of samples for testing properties of modified starch 6. Characterization of the properties of modified starchFabrication of exemplary products 7. Assessment of the applicability potential for the modified starch 8. Analysis of the results 9. Summary and conclusions with regard to industrial applications	571-443-056	k.kurzydlowski@pb.edu.pl
6.	prof. dr hab. inż. Romuald Paweł Mosdorf	Improving boiling heat transfer in mini-channel systems by employing woven metal mesh coverings - modeling and experiment.	1. Review of the literature on boiling in systems with mini-channels and on boiling in those mini-channel systems that employ woven metal mesh coverings. 2. Development of a heat and mass transfer model in systems with mini-channels covered with a mesh. 3. Analysis of the influence of mesh dimensions and types on the heat transfer intensity. 4. Development of a method to enhance heat and mass transfer in mini-channel systems covered with woven mesh by modifying the pressure over the mesh. 5. Performing experimental tests of heat and mass transfer in systems with mini-channels covered with woven meshes. 6. Summary and conclusions on the application of work results.	571-443-031	r.mosdorf@pb.edu.pl

7.	dr hab. inż. Piotr Grześ, prof. PB	Numerical modeling of the frictional heating process in braking systems of railway vehicles	1. Literature review on numerical modeling of temperature, stress and wear distributions in railway vehicle braking systems. 2. Development of geometrical models of braking systems, taking into account the elements reinforcing the friction material. 3. Braking simulation using contact coupled computational models of brakes to determine transient fields of temperature, stress, contact pressure and wear. 4. Summary and conclusions.	571 443 026	p.grzes@pb.edu.pl
8.	dr hab. inż. Marek Jałbrzykowski, dr hab. inż. Robert Przekop, prof. UAM	Influence of the surface microstructure of objects made of polymeric materials on their functional properties	1. Literature review on the influence of surface morphology on the usable and functional properties of polymeric materials (ABS, PET, PLA, PA, PE, PP). 2. Description of the methods of producing surface geometry of injection molded products. 3. Selection of construction geometry as a factor determining selected usable and functional properties of products. 4. Making an injection mold cavity with a specific surface structure in order to prepare samples of injection molded products for testing. 5. Performing tests of changes in the functional properties of products after surface structuring. 6. Development of a model and mechanisms of the influence of selected structures on the functional properties of products. 7. Summary and conclusions.	571-443-081	m.jalbrzykowski@pb.edu.pl
9.	dr hab. inż. Zbigniew Kamiński prof. PB	Determination of the flow characteristics of pneumatic brake valves	1. Influence of the flow properties of pneumatic elements on the transient processes in pneumatic braking systems (speed , synchronisation of operation) and the performance of the vehicle braking process (efficiency, stability). 2. Review of mathematical models of air flow through various pneumatic elements. 3. Review of methods and positions for determining flow characteristics of pneumatic components, including brake valves. Choice of method. 4. Development of a methodology for determining flow characteristics of brake valves using indirect (reservoir) and direct methods. 5. Construction of a test rig and physical experiments on air flow through the test components. 6. Development of a computer programme for numerical identification of parameters of flow characteristics of brake valves. 7. Validation of flow characteristic models of brake valves and other pneumatic components. 8. Summary and conclusions.	571-443-071	z.kaminski@pb.edu.pl

10.	dr hab. inż. Zbigniew Kamiński prof. PB	Modelling and simulation of the dynamics of air braking systems of agricultural vehicles	1. Static and dynamic requirements for braking systems. 2. Basics of modelling air brake systems. 3. Review of methods for modelling the dynamics of air brake systems. Choice of method. 4. Development of mathematical models of individual pneumatic components of the system (valves, lines, actuators). 5. Development of a library of pneumatic components in an object-oriented or signal-oriented programming environment (e.g. Matlab -Simulink). 6. Experimental and simulation studies of multi-circuit pneumatic braking systems. 7. Validation of the developed models. 8. Summary and conclusions.	571-443-071	z.kaminski@pb.edu.pl
11.	dr hab. inż. Andrzej Koszewnik, prof. PB	Design and experimental verification of vibration-based Energy harvesting systems for support and development of structural health monitoring of chosen mechanical structures	1. State of the art in the range of vibration-based energy harvesting system applied in 1D and 2D structures 2. Numerical analysis of intact and damage mechanical structures to determine of quasi-optimal location piezo path harvester on the structure. 3. Design of vibration-based energy harvesting systems 4. Determine of methodology related to level of damage in chosen mechanical structures 5. Experimental verification 6. Analysis of the obtained results, summary and conclusions	571-443-052	a.koszewnik@pb.edu.pl
12.	dr hab. inż. Andrzej Koszewnik, prof. PB	Determine of methodology of fault detection of the unmanned aerial systems by using piezo-patch sensors	1. State of the art in the filed of fault detection in mechanical systems with using piezo-elements 2. Influence of chosen parameters of unmanned aerial systems to voltage generating by the piezo sensors 3. In-door and out-door testing of the proposed EH system 4. Using reccurence analysis to determine parameters of EH system before, during and after damage 5. Design control low for damage UAS 6. Experimental verification of the designed control low 7. Analysis of the obtained results, summary and conclusions	571-443-052	a.koszewnik@pb.edu.pl
13.	Dr hab. inż. Cezary Kownacki, prof. PB	The use of artificial intelligence to control the flight of unmanned aerial	1. Literature review on the use of artificial intelligence in unmanned aerial vehicles and the control algorithms applied, 2. Development of the neural network structure, machine learning methods	+48 571 443 054	c.kownacki@pb.edu.pl

		vehicles in the fixed-wing and multi-rotor helicopter systems	and algorithms for controlling and stabilizing the flight of an unmanned aerial vehicle in the fixed-wing and multi-rotor helicopter system, 3. Simulation studies and optimization of developed structures of neural networks and algorithms, 4. Construction of research framework for experimental implementation and verification of the developed control based on neural networks, 5. Experimental verification of the developed neural networks and control algorithms in the area of flight stabilization and desired flight path following, 6. Analysis of the results obtained and corrections of algorithm parameters, 7. 7. Summary and conclusions		
14.	PhD, DSc Kanstantsin Miatluk	Conceptual design of selected robotic and mechatronic systems using the hierarchical systems method	1. Literature review on methods of designing robotic and mechatronic systems. 2. Development of a method of conceptual design of a selected robotic system in the formal basis of hierarchical systems. 3. Implementation of a computer design processes of a selected robotic system. 4. Carrying out a detailed design and development of a selected robotic system. 5. Tests and analysis of the developed robotic system in laboratory conditions. 6. Summary and conclusions.	571-443-057	k.miatliuk@pb.edu.pl
15.	dr hab. inż. Grzegorz Mieczkowski	Modelling and fabrication of 0-3 type piezoelectric composites.	1. Literature review on the application, modeling, and fabrication of piezoelectric composites. 2. Familiarization with experimental methods for manufacturing and determining the effective mechanical and physical properties of composites. 3. Selection/development of a model for predicting the effective properties of the composite. 4. Analysis of the influence of geometric and material parameters of the piezoelectric fraction and matrix on the effective properties of the composite using the selected/developed model. Comparison of the obtained results with existing experimental data in the literature. 5. Determination of the microstructure of the composite with desired mechanical and physical properties using the selected/developed model, and preparation of composite material samples. 6. Conducting laboratory tests on the fabricated piezoelectric composite.	571443073	g.mieczkowski@pb.edu.pl

			7. Summary and conclusions.		
16.	Dr. Dariusz M. Perkowski, Prof. PB dr. Ing. Habil. Malgorzata Kopycinska-Müller Fraunhofer-Institut für Keramische Technologien und Systeme IKTS	Experimental studies and numerical modelling of the fracture process in fibre composites	1. A review of the literature on experimental studies and modelling of the fracture process of fibre composites. 2. Preparation of samples for experimental studies. 3. Development of a multi-scale fracture model of a fibre composite using the finite element method based on real composite structures. 4. Performing numerical fracture calculations of a fibre composite. 5. Verification of the simulation results obtained based on the experimental studies carried out with OCT (Optical Coherence Tomography). 6. Summary and conclusions.	Dariusz Perkowski 571 443 034 Kopycinska-Müller, Malgorzata +49 351 88815-541	Dariusz Perkowski d.perkowski@pb.edu.pl Kopycinska-Müller, Malgorzata malgorzata.kopycinska-mueller@ikts.fraunhofer.de
17.	Dariusz M. Perkowski, Ph.D., Prof. PB	Experimental testing and numerical modelling of sandwich composite structures	1. A review of the literature on experimental studies and modelling of the fracture process of sandwich composites. 2. Preparation of samples for experimental studies. 3. Development of a multi-scale fracture model for sandwich composite structures using the finite element method. 4. Performing numerical fracture calculations of sandwich composites. 5. Verification of the simulation results obtained based on the experimental tests carried out. 6. Summary and conclusions.	571 443 034	d.perkowski@pb.edu.pl
18.	PhD, DSc Kanstantsin Miatluk PhD Roman Trochimczuk	Force and displacement control in a robotic system supporting lymphoedema rehabilitation	1. Review of the literature on robotic rehabilitation systems as well as procedures and issues of massage for lymphatic drainage. 2. Evaluation of analysis methods of robotic rehabilitation systems and their methods of modelling, controlling, constructing and simulating. 3. 3Development of the structure and construction of a robotic rehabilitation system. 4. Development of algorithms for the rehabilitation control of the surgical system. 5. Experimental verification of the developed solution. 6. Summary and conclusions.	571-443-057	k.miatliuk@pb.edu.pl
19.	dr hab. inż. Jarosław Szusta, prof. PB	Optimization of the shrink sleeve label shrinking process under industrial production conditions	1. Review of the literature on shrink sleeve films, their production process, processing, shrinking. 2. Study of properties of shrink sleeve films (mechanical properties, anisotropy studies, determination of shrinkage curves). 3. Development of assumptions and design guidelines for the shrink sleeve label shrinking process.	513 052 586	j.szusta@pb.edu.pl

			4. Development of a design solution for the test stand for shrinking labels. 5. Research on the effect of nozzle and feed system parameters on the quality of the shrinking process. 6. Selection of the optimal geometry of the execution tool. 7. Development of a quantitative method for evaluating the quality of the shrink labeling process. 8. Summary and conclusions.		
20.	dr hab. inż. Jarosław Szusta, prof. PB	Investigation of strength properties including fatigue of materials performed on flat specimens with small thicknesses	1. Review of the literature on strength and fatigue testing materials. 2. Development of the design of a test stand that allows the implementation of the fatigue process with a cycle asymmetry factor of R=-1. 3. Preparation of applied patent applications in the work topic. 4. Development of a test plan for determining the strength properties of materials on flat specimens of small thickness. 5. Conducting tests in the determination of material parameters on flat specimens of small thickness. 6. Analyze the obtained results. 7. Conducting numerical simulation of the operation of the developed stand. 8. Summary and conclusions.	513 052 586	j.szusta@pb.edu.pl
21.	dr hab. inż. Jarosław Szusta prof. PB	Recycling of composite materials and its reuse in industry	1. Review of the literature on the research topic. 2. Development of assumptions and design guidelines for the form of recycled composite reinforcement. 3. Classification of structures for obtaining raw material for recycling. 4. Development of concepts for sourcing processed continuous reinforcement. 5. Development of a test program and preparation of test samples 6. Conducting tests to determine the properties of the extracted composite reinforcement 7. Optimization of the geometry of the recycled composite continuous reinforcement. 8. Testing the effect of the application of recycled composite reinforcement on the properties of reinforced elements. 9. Summary and conclusions.	513 052 586	j.szusta@pb.edu.pl
22.	dr hab. inż. Krzysztof Kamil Żur, prof. PB	Nonlinear dynamics and flutter of nanohybrid composite panels under	1. Literature survey for dynamics and stability of nanocomposite panels. 2. Determining the effective material properties for different nanocomposite layers using appropriate homogenization techniques. 3. Derivation of nonlinear equations of motion for the nanohybrid panel with layers reinforced by graphene platelets and carbon nanotubes via	503 539 352	k.zur@pb.edu.pl

		coupled aero-thermal loads	Hamilton's variational principles. 4. Application of selected meshless numerical techniques to solve formulated nonlinear boundary value problems. 5. Convergence study for obtained solutions and verification of the results. 6. Numerical investigations for linear/nonlinear vibration and dynamic instability of the panel with different boundary conditions and aero-thermal loads. 7. Interpretation of results to explain effects of hybridization of nanocomposite layers as well as aerodynamic pressure in a thermal environment on instability zones and shifting of natural frequencies of the panel. 8. Conclusions and perspectives of future research.		