MINUTES OF THE PhD STUDY BOARD MEETING

PhD Study Program: Engineering of Agricultural Technological Systems (EATS)

The PhD Board meeting for the PhD study program in Engineering of Agricultural Technological Systems (EATS) was held in person on January 29th, 2025, at 9:00 AM in the Consultation Room at the Faculty of Engineering, CZU. The attendance list is attached.

AGENDA:

1. **Welcome and Introduction**

    - Prof. Herak, Head of the PhD Board, opened the meeting.

2. **Presentation on Progress of Dissertation Research by PhD Student Mr. Vijay Chandan**

    - Mr Chandan's presentation highlighted the near-completion of the objectives outlined in his thesis research, showcasing his readiness for the final defence. Committee members raised questions on several key topics: the fulfilment of the study's goals, the application of automotive standards and norms, technical aspects of the use of English, and the timeline for the final steps leading to the thesis defence.

    - The Head of the PhD Board reminded Mr. Chandan that, according to the board's decision on January 17, 2022, only a thesis based on a collection of articles is accepted for the successful completion of the EATS program. However, per established practice, PhD Board-approved rules typically take effect at the start of the following academic year, which in this case was September 30, 2022. Since Mr. Chandan enrolled in the program on January 28, 2022, before the new academic year began, the board agreed to allow him to submit his dissertation as a traditional research thesis.

3. **Approval of Progress for PhD Student Mr Vijay Chandan**

    - The PhD Board recommended that Mr. Chandan continue in the PhD study program – EATS.

4. Approval of Drafts of New Dissertation Topics

- The PhD Board unanimously approved all the dissertation topics presented.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Asc. Prof. Zdeněk Aleš, Ph.D.
Department	Department of Quality and Dependability of Machines
Topic	**Multicriteria Analysis of Reliability**
Annotation	The aim of the dissertation thesis is to develop a methodology for multicriteria analysis of reliability for technical systems. This methodology will integrate multiple reliability factors such as failure probability, maintenance costs, operational availability, and environmental impacts into a comprehensive evaluation framework. The thesis will involve creating a mathematical model that uses multicriteria decision-making techniques to analyze various reliability scenarios. Validation of the proposed methodology will be performed through case studies in fields like transportation, or industrial automation. The student will compare the results with traditional reliability analysis approaches and assess the benefits of the proposed method.
Compliance with targets of EATS study program	The dissertation thesis aligns with the objectives of the EATS study program, focusing on innovative strategies for reliability assessment of machines.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Prof. Ing. David Herák, Ph.D.
Department	Mechanical Engineering
Topic	**Utilisation of the finite element method to describe the mechanical behavior of oilseeds under compression loading**
Annotation	The dissertation thesis aims to create comprehensive models of the mechanical behaviour of oilseeds using the finite element method. These models will describe the mechanical behaviour of the bulk seeds under compression loading, the relaxation behaviour, the

	creep behaviour, as well as the oil points. Models should be used to create the "digital twin of the seed", which will show the same mechanical and physical behaviour as the real oilseed in the context of oilseed pressing. Models should be created using the ANSYS system.
Compliance with targets of EATS study program	The topic fits into the essence of the idea of Industry 4.0 and Agriculture 4.0, respectively.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	prof. Rajesh Kumar Mishra, Ph.D.
Department	Material Science and Manufacturing technology
Topic	**Bio-based reinforcement of soil to prevent erosion**
Annotation	This research is aimed to investigate the mechanical and functional behavior of natural fiber-based 3D woven geotextile fabrics used in soil protection. An exploratory work will be carried out in the field of soil erosion protection in which natural cellulosic fiber-based 3D woven fabrics will be used in geo-reinforcement. The thesis will be focused to investigate the soil reinforcing performance of 3D fabrics having various structures in comparison with 2D fabrics. The gap in the research of 3D woven geotextiles has given the opportunity to carry out the research work further. Analysis of structures, properties and their interrelationships in order to optimize the design parameters of 3D woven architecture. Characterization of 3D woven structural geotextiles with respect to functional properties such as soil erosion protection, mechanical and environmental performance. • Modeling the 3D fabric structure: The structure of 3D woven architecture will be modeled with regard to its geometry for soil reinforcement • Prediction of mechanical properties: The mechanical properties will be predicted using computing tools (ANSYS, ABAQUS, Solidworks)

	• Simulation of erosion resistance performance: The erosion resistance will be simulated for soil reinforced with 3D woven structures under different soil condition, rainfall and snowfall. • Validation of predicted results: The predicted results will be validated with experimental samples for optimization of 3D fabric structures without and with soil.
Compliance with targets of EATS study program	The topic is inline with the study program EATS, Industry-4.0/5.0, Agriculture-4.0/5.0.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	prof. Rajesh Kumar Mishra, Ph.D.
Department	Material Science and Manufacturing Technology
Topic	**Bio-degradable composite food packaging using micro/nano fillers from cellulosic waste materials**
Annotation	The research aims at developing a new generation of packaging materials derived from bio-based polymers and reinforced with micro/nanocrystalline cellulose so as to make it degradable at the end of life while retaining its basic functionality. The biopolymers will be based on Polyvinyl alcohol (PVA), Polylactic acid (PLA), bacterial cellulose etc. The nanocellulose will be derived from agro waste fibrous materials. A nontoxic top-down approach based on planetary ball milling will be involved to derive nanocrystalline cellulose from waste fibers. The mechanical, chemical recycling of the new packaging materials used in the food packaging industry will be achieved. The balance between the mechanical and chemical stability while protecting the content and at the same time easy and environment friendly degradation/recycling at the end of life will be investigated.
Compliance with targets of EATS study program	The topic is inline with the study program EATS, Industry-4.0/5.0, Agriculture-4.0/5.0.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Doc. Ing. Abraham Kabutey, Ph.D.
Department	Mechanical Engineering
Topic	**Evaluation of thermal pretreatment effect on the oil processing parameters of selected oilseeds under screw pressing**
Annotation	Mechanical pressing is widely used for oil extraction from edible oilseeds due to its several advantages such as high-oil quality production. From the literature perspective, continuing research is still required to understand the complexities in mechanical screw pressing operation in terms of the input processing factors such as heating temperature, heating time, moisture content, applied pressure, among others. These input factors thus affect the pressing process regarding the oil extraction efficiency, energy requirement and the residual oil in the press cake. These factors can be understood first under the laboratory-scale research by applying appropriate experimental designs, statistical techniques and optimization concepts to achieving higher quality of oil, higher oil extraction efficiency and optimal energy efficiency. In this research, the oilseeds will be selected based on literature information.
Compliance with targets of EATS study program	The dissertation thesis is within the EATS study programme to aid in the design of an efficient oil extraction systems.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Doc. Ing. Abraham Kabutey, Ph.D.
Department	Mechanical Engineering
Topic	**Investigation of mechanical and rheological properties of bulk oilseeds under quasi-static and dynamic loadings**

Annotation	The static mechanical test techniques can be extended to evaluate bulk oilseeds processing performance under dynamic loading conditions which is a vital research hypothesis that needs to be investigated. The research is seeking to obtain adequate information on both the experimental and theoretical concepts of the mechanical and rheological properties of bulk oilseeds under quasi-static and dynamic loading tests using the universal compression testing machine. Quasi-static and dynamic compression experiments of bulk oilseeds will be conducted at different input processing factors. The influence of the input processing factors on the mechanical and rheological properties of bulk oilseeds under quasi-static and dynamic loadings will be examined. Multivariate data techniques will be employed to analyze the determined responses.
Compliance with targets of EATS study program	The dissertation thesis is within the EATS study programme and Agriculture 4.0. to aid in the design of an efficient oil extraction systems.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Doc. Ing. Abraham Kabutey, Ph.D.
Department	Mechanical Engineering
Topic	**Assessment of physiochemical properties, fatty acids compositions, colour and sensory attributes of edible oils under different extraction methods**
Annotation	Quality edible oil parameters need to be established to preserve consumer awareness and safety. The nutritional value and sensory characteristics of edible oils are compromised by rancidity development leading to spoilage. The sensory qualities of edible oils include colour, brightness, smell, flavour and aroma as well as the age of the oil which are influenced by several factors during the production process. Edible oils will be extracted under mechanical screw and linear pressing methods. The sensory qualities of the extracted oils will be evaluated by using a combination of sensory and analytical methods. The chemical properties namely peroxide

	value, acid value, iodine value and free fatty acid among others will be examined by means of a titration procedure. The quality of edible oils is also influenced by its fatty acid composition which will be analysed using appropriate instrumentation.
Compliance with targets of EATS study program	The dissertation thesis is within the EATS study programme to aid in the design of an efficient oil extraction systems.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Doc. Ing. Abraham Kabutey, Ph.D.
Department	Mechanical Engineering
Topic	**Adoption of machine learning algorithms for describing drying kinetics of selected agricultural products**
Annotation	The drying of agricultural produce entails a complex thermal process in which simultaneous heat and mass transfer occur. The process ensures the reduction of moisture content in the agricultural product to extend the shelf life. The drying kinetics of a product depends on various factors such as hot air-speed, initial moisture content, final moisture content, relative humidity, temperature, dimensions, form, composition, external surface, intermittence, pressure, and porosity, among others. Kinetic modelling of process parameters by employing supervised machine learning models such as linear regression, K-means clustering, support vector machine among others is very useful in food processing. Selected agricultural produce will be examined under various drying conditions where the input and output drying parameters will be subjected to statistical, modelling and optimization techniques.
Compliance with targets of EATS study program	The dissertation thesis is within the EATS study programme to aid in the design of an efficient oil extraction systems.

PhD Program	**Engineering of Agricultural Technological Systems**
Supervisor	Prof. Ing. David Herák, Ph.D.
Department	Mechanical Engineering
Topic	**Digital Agriculture for Enhancing Smallholder Palm Oil Farming in Indonesia**
Annotation	The dissertation thesis aims to explore the implementation of digital agriculture technologies and their influence on the productivity, sustainability, and economic resilience of smallholder palm oil farmers in Indonesia. The research will focus on developing data-driven models that incorporate precision agriculture tools, such as remote sensing, IoT-based monitoring systems, and predictive analytics, to optimise plantation management and resource allocation. These models will evaluate the impact of digital solutions on yield improvement, environmental conservation, and market access. The findings will serve as the basis for creating a "digital twin of the farm," simulating the physical and operational dynamics of smallholder farms to provide actionable insights and decision-making support.
Compliance with targets of EATS study program	The topic fits into the essence of the idea of Industry 4.0 and Agriculture 4.0, respectively.

5. Any Other Business

- The discussion turned to strengthening international cooperation within the PhD study program.
- Additionally, the upcoming amendment to the Higher Education Act and its potential impact on PhD studies was addressed.

Prague, January 29th, 2024

Digitálně podepsal prof. Ing. David Herák, Ph.D.
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prof. Ing. David Herák, Ph.D.
Head of PhD Board