HORIZON EUROPE Research and Innovation Framework Programme
MARIE SKŁODOWSKA-CURIE ACTIONS

INVITATION TO APPLY FOR
MSCA4Ukraine Fellowship Programme

Organisation Name/ Department	Czech University of Life Sciences Prague/Faculty of Engineering, Department of Electrical Engineering and Automation, Department of Agricultural Machines
Website of the organisation	https://www.tf.czu.cz/en https://www.facebook.com/tf.czu.cz https://www.instagram.com/tfczucz/
Research Fields	☐ Chemistry (CHE) ☐ Social Sciences and Humanities (SOC) ☐ Economic Sciences (ECO) ☒ Information Science and Engineering (ENG) ☒ Environment and Geosciences (ENV) ☒ Life Sciences (LIF) ☐ Mathematics (MAT) ☐ Physics (PHY)
Sub-Fields/ Keywords	Precision agriculture, Robotics, Autonomous vehicles, Agrivoltaic systems, Digital twin, Discrete element method, Finite element method, Abrasive wear modelling
Marie Skłodowska-Curie Action(s) 4Ukraine	☒ **Postdoctoral Fellowships** (researchers with a possession of a doctoral degree by the time the fellowship is set to begin) Duration: 6-24 months ☒ **Doctoral Candidates** (enrolled in a doctoral programme at a higher education institution in Ukraine, leading to the award of a doctoral degree) Duration: 6-24 months

Short Description of the Organisation/ Department	**DESCRIPTION OF THE ORGANISATION/ DEPARTMENTS:**
	EXPERTISE: Our team of experts has comprehensive experience in smart solutions for the use of new technologies in the agri-food sector and its digitalization, precision agriculture and development, such as monitoring, collecting and analyzing data, design and construction of agricultural drones and robots, including digital twins, machinery and soil processing simulation via FEM and DEM, live parameters monitoring, laboratory and computational results evaluation and also development of agrivoltaic systems. **RESEARCH TEAM COMPOSITION:** The research team consists of professor, associate professors, assistant professors, Ph.D. students: ✓ prof. František Kumhála (ORCID 0000-0002-7782-6033) ✓ Assoc. prof. Jitka Kumhálová, (ORCID 0000-0002-0867-411X); ✓ Assoc. prof. Rostislav Chotěborský (ORCID 0000-0002-8694-4453); ✓ Assoc. prof. Miloslav Linda (ORCID 0000-0003-2753-4144); ✓ Assoc. prof. Monika Hromasová (ORCID 0000-0001-5849-1955); ✓ Assist. prof. Egidijus Katinas (ORCID 0000-0002-1908-4465); ✓ PhD student Ing. Jiři Kuře (ORCID 0000-0002-1706-0267) ✓ PhD student Ing. Barbora Černilová (ORCID 0000-0003-4493-7957) **STRENGTHS AND SCIENTIFIC ACHIEVEMENTS:** **Important publications:** 1. Katinas, Egidijus; Choteborsky, Rostislav; Linda, Miloslav; Kure, Jiri. *Sensitivity analysis of the influence of particle dynamic friction, rolling resistance and volume/shear work ratio on wear loss and friction force using DEM model of dry sand rubber wheel test // Tribology* International ISSN 0301-679X, 2021, vol. 156, p. 106853. DOI.org/10.1016/j.triboint.2021.106853. Science Citation Index Expanded (Web of Science); ScienceDirect; INSPEC; CAB Abstracts; Scopus. WOS, IF: 4.872, AIF: 3.44, cat: 1, av: 1.416, 2020, Q1] [SCOPUS, citescore: 8, snip: 2.061, sjr: 1.401, year: 2020, quartile: Q1];

2. Kesner, Adam; Choteborsky, Rostislav; Linda, Miloslav; Hromasova, Monika; Katinas, Egidijus; Sutanto, Hadi. *Stress distribution on a soil tillage machine frame segment with a chisel shank simulated using discrete element and finite element methods and validate by experiment // Biosystems engineering.* ISSN 1537-5110, vol. 209, p. 125-138. doi.org/10.1016/j.biosystemseng.2021.06.012. Science Citation Index Expanded (Web of Science); ScienceDirect; Scopus. WOS, IF: 4,123, 2020, Q1] [SCOPUS, citescore: 7.2 snip: 2.120, sjr: 0.894, year: 2020, quartile: Q1];

3. Katinas, Egidijus; Choteborsky, Rostislav; Linda, Miloslav; Jankauskas, Vytenis. *Wear modelling of soil ripper tine in sand and sandy clay by discrete element method // Biosystems engineering. San Diego: Academic Press Inc Elsevier Science.* ISSN 1537-5110, 2019, vol. 188, p. 305-319. DOI:10.1016/j.biosystemseng.2019.10.022. Science Citation Index Expanded (Web of Science); ScienceDirect; Scopus. WOS, IF: 3.215, AIF: 3.471, cat: 2, av: 1.326, 2019, Q1] [SCOPUS, citescore: 6.4, snip: 1.97, sjr: 0.857, year: 2019, quartile: Q1] [ai: 0.354, iai: 0.354, na: 4, nia :2, nip: 1, pai: 1.01, piai: 1.01, al: 1.071];

4. Rataj, Vladimír; Kumhálová, Jitka; Macák, Miroslav; Barát, Marek; Galambošová, Jana; Chyba, Jan; Kumhála, František. *Long-Term Monitoring of Different Field Traffic Management Practices in Cereals Production with Support of Satellite Images and Yield Data in Context of Climate Change // Agronomy*, 2022, ISSN: 2073-4395, vol. 12, iss. 1, article number 128.

5. LEV, J. – KŘEPČÍK, V. – ŠARAUSKIS, E. – KUMHÁLA, F. *Electrical Capacitance Characteristics of Wood Chips at Low Frequency Ranges: A Cheap Tool for Quality Assessment. SENSORS*, 2021, ISSN: 1424-8220.

6. KADEŘÁBEK, J. – SHAPOVAL, V. – MATĚJKA, P. – KROULÍK, M. – KUMHÁLA, F. *Comparison of Four RTK Receivers Operating in the Static and Dynamic Modes Using Measurement Robotic Arm. SENSORS*, 2021, ISSN: 1424-8220

Patent:

- ✓ Capacitance transducer of particulate material permeability with compensation of temperature - Kumhála František, Kavka Miroslav, Prošek Václav

IMPORTANT INFRASTRUCTURE:

- ✓ Server 72 cores, 3 TB RAM for FEM, Server 2 x GPU P100 for DEM, PC with V100 32 GB RAM for DEM.

	Software Ansys multiphysics (mechanics and fluent) for FEM and Rocky DEM. ✓ Daily using CNC machines, CNC laser for plastics and wood, making mould and vacuum forming, making carbon fibre and glass fibre parts. Development of self-filament for 3D printing. ✓ Soil bin for testing newly designed soil tillage tools, validation of FEM boundary conditions and verification of digital twins accuracy, length 10 m, width 3 m, depth 1.5 m, maximum tensile force 30 kN, speed up to 4 m / s. ✓ Computer laboratory equipped with software (ArcGIS, QGIS, SNAP, ENVI, SMS, Pix4D) for spatial data and image analysis with appropriate hardware. ✓ Multicopters and fixed wings (eBee X) to retrieve data for precision agriculture forestry purposis. ✓ Multispectral and thermal cameras. ✓ Functional prototypes of agricultural and forestry drones developed for special purposes (eg spraying individual trees), own solutions. ✓ Laboratory equipment for rapid analysis of soil granular composition - optical particle size analyzer HORIBA LA 960.
Previous Projects/ Research Experience	**National Scientific Projects:** ✓ The digital twin of the agricultural machine ✓ Modularity of agricultural machinery supported by advanced manufacturing technologies ✓ R&D of working tools of agricultural machinery ✓ Research and development of smart farming technologies for small and medium-sized farms ✓ Research of the systems for increasing soil tillage energy efficiency ✓ R&D of coconut processing line ✓ Improving the WASH sector in Kampong Chhnang Province – Cambodia **International Scientific Projects:** ✓ NICOPA - New and Innovative Courses for Precision Agriculture
Thematic areas and a list of supervisors who are going to participate in preparing a project proposal with researchers.	**THEMATIC AREA:** Precision agriculture, Robotics, Autonomous vehicles, Agrivoltaic systems, Digital twin, Soil processing model, Discrete element method (DEM), Finite element method (FEM), Wear analysis. **SUPERVISORS:** **prof. Dr. Ing. František Kumhála (FK) and Ing. Egidijus Katinas PhD. (EK)** • **Current position:** FK: Since 2011 Professor at Czech University of Life Sciences Prague.

EK: Since 2021 Asistant professor at Czech University of Life Sciences Prague.

- **Professional profile:**

FK:

- ✓ 46 publications on Web of Science Core Collection
- ✓ 21 publications with impact factor
- ✓ Chairman of the Department of Agricultural Engineering, Energy and Construction of the Czech Academy of Agricultural Sciences

EK:

- ✓ 10 publications with impact factor,
- ✓ Master thesis awarded in the field of technology science (2016),
- ✓ Scholarship for PhD students for study results from Research Council of Lithuania (2017-2018).

- **Research experience & Education:**

FK:

- ✓ 2014 – present: Chief of Department of Agricultural Machines, Faculty of Engineering, CZU Prague
- ✓ 2011 – present: Full professor on Department of Agricultural Machines, Faculty of Engineering, CZU Prague
- ✓ 2004-2011 Associate professor on Department of Agricultural Machines, Faculty of Engineering, CZU Prague
- ✓ Main solver and solver of national and international research projects

EK:

- ✓ Since 2021 Asistant professor at Czech University of Life Sciences Prague.
- ✓ 2020-2021 Postdoc fellowship at Czech University of Life Sciences Prague;
- ✓ 2017-2018 junior researcher at Aleksandras Stulginskis University;
- ✓ 2015-2019 PhD, Vytautas Magnus University;
- ✓ 2013-2015 Master degree, Aleksandras Stulginskis University;
- ✓ 2009-2013 Bachelor degree, Aleksandras Stulginskis University.

Short description of the fellowships programme	**Researcher activities will be focused on the following areas:**
	✓ design and construction of agriculture drones and autonomous vehicles for different tasks,
	✓ development and production of our own electric drone power units with significantly lower energy consumption

	✓ 3D printing in the construction of agricultural drones, application of rapid prototyping,
	✓ application of drones and autonomous vehicles in the program of precision agriculture,
	✓ agrivoltaic systems for combined production of photovoltaic power and agricultural crops,
	✓ FEM and DEM method application in agriculture and soil processing,
	✓ design and development of soil processing tools,
	✓ real-time data measurement, processing, and analysis during the soil processing,
	✓ soil processing, fertilizing and seeding processes simulation and analysis by the DEM,
	✓ measurement, evaluation, simulation of soil properties and their analysis,
	✓ simulation of mixing, transportation, processing of granular material used in food, agriculture, chemical industries (fruits, vegetables, grains, pills, etc.) can be performed with a knowledge acquired through experience of soil processing,
	✓ abrasive wear analysis, simulation, worn surface comparison to the actual shape
Contact Person/ Position in the Organisation/ Phone/ E-mail	Pavlina Ruzickova project manager email: ruzickova@tf.czu.cz phone: + 420 605 294 906
Deadline for Expressions of Interest	**30 November 2022**
Necessary documents from applicants	Please send us an application by email to ruzickova@tf.czu.cz including following documents: ✓ **CV** ✓ **List of publications** ✓ **Brief description of the project idea** (see the template here) (a *project proposal will be made jointly by the researcher and a host institution*)
What we offer	✓ **Full-time contract to work** on a research project and enjoy advanced training, ✓ **Competitive salary** – rates in line with MSCA Doctoral Networks and MSCA Postdoctoral Fellowships reduced by country correction coefficient 79,1 % ✓ **Mobility and Family allowances** (if applicable); ✓ **Budget for Research, Training and Networking costs**; ✓ **Special needs allowance** (if applicable). ✓ HR Excellence in Research Award, granted by European Commission for **transparent educational and scientific research environment**

Eligibility of Applicants	✓ **For Postdoctoral Fellowships** - applicants should be in a possession of a doctoral degree by the time the fellowship is set to begin.
	✓ **For Doctoral candidates** – applicants should be enrolled in a doctoral programme at a higher education institution in Ukraine, leading to the award of a doctoral degree
	✓ **Applicants should be** (a) (1) **Ukrainian nationals**, or (2) stateless persons, or nationals from third countries other than Ukraine, **with their primary residence in Ukraine on 24 February 2022**; (b) either (1) have been displaced on or after 24 February 2022, or (2) are ready to be displaced from Ukraine
	✓ **Applicants should have the language skills** required to successfully conduct their research activities at the envisaged host institution – English, Czech or Slovak at the communicative level
	✓ **Applicants should have experience in the field of biosystems engineering and/or agriculture. Experience can be proven by the article, thesis, project or working experience in the agricultural company**.