

Razpis za mlade raziskovalke in raziskovalce v letu 2025 v Laboratoriju za sinergetiko (Call for young researchers in 2025 at the Laboratory of Synergetics)

Razpisna dokumentacija na strani UL (*Documentation on the UL website*)

- <https://www.uni-lj.si/univerza/javne-objave/razpis-za-mlade-raziskovalke-in-raziskovalce-2>
- <https://www.uni-lj.si/en/university/public-announcements/call-to-tender-for-young-researchers>

Opis raziskovalnega dela (*Research work description*)

1. Članica UL (*UL member*):

Fakulteta za strojništvo (*Faculty of Mechanical Engineering*)

2. Ime, priimek in elektronski naslov mentorja/ice (*Mentor's name, surname and email*):

Primož Potočnik, primoz.potocnik@fs.uni-lj.si

3. Raziskovalno področje (*Research field*):

Področje: Tehnološko usmerjena fizika (*Technology driven physics*)

Tematika: Uporaba strojnega učenja v aditivnih tehnologijah (*Application of machine learning in additive technologies*)

4. Opis raziskovalnega dela (*Research work description*):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (*It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.*).

Slov.:

Raziskovalno delo bo potekalo na Fakulteti za strojništvo v Ljubljani v okviru Laboratorija za sinergetiko (LASIN). Osrednje raziskovalno področje bo uporaba metod strojnega učenja in nevronske mreže za optimizacijo laserskih dodajnih procesov (LDP). Cilj raziskovalnega dela mladega raziskovalca je razvoj inovativnih metod za izboljšanje stabilnosti procesov in s tem povezane kakovosti izdelkov in povečane dimenzijske točnosti, ter napovedovanje lastnosti materialov in procesno vodenje z uporabo naprednih analitičnih pristopov. Raziskave bodo obsegale tako teoretično modeliranje, kot tudi eksperimentalno delo na laboratorijski opremi za direktno lasersko depozicijo (DLD) in selektivno lasersko taljenje (SLM) kovinskih materialov.

Glavne naloge kandidata:

- Raziskave in modeliranje procesov direktne laserske depozicije in selektivnega laserskega taljenja.
- Identifikacija ključnih senzorjev in merljivih spremenljivk za spremljanje in diagnostiko LDP procesov.
- Optimizacija procesnih parametrov za izboljšanje kakovosti in ponovljivosti aditivnih tehnologij.
- Načrtovanje optimalnih poti nanašanja materialov glede na obliko izdelka.
- Razvoj metod za prediktivno vodenje LDP procesov.
- Razvoj algoritmov strojnega učenja za analizo in optimizacijo LDP procesov.
- Eksperimentalno validiranje razvitega modela na laboratorijski opremi (industrijski 3D tiskalnik LASERTEC 30 SLM in lastno razviti DLD sistem s 6-osnim robotskim sistemom ABB).
- Priprava in objava znanstvenih člankov v mednarodnih revijah ter predstavitve na strokovnih konferencah.

Zahtevane kvalifikacije:

- Zaključen magistrski študij na področju strojništva, materialov, računalništva ali sorodnih disciplin.
- Osnovno poznavanje aditivnih tehnologij in metod strojnega učenja.
- Izkušnje s programskimi orodji, kot so Python, MATLAB in ANSYS.
- Aktivno znanje angleškega jezika (pisno in ustno).
- Sposobnost samostojnega raziskovalnega dela in analitičnega razmišljanja.
- Zmožnost znanstvenega pisanja in priprave publikacij.

Eng.:

The research work will be carried out at the Faculty of Mechanical Engineering in Ljubljana within the Laboratory for Synergetics (LASIN). The main research area will be the application of machine learning methods and neural networks for the optimisation of laser additive manufacturing (LAM) processes. The aim of the young researcher's research work is to develop innovative methods for improving process stability and related product quality, and dimensional accuracy, as well as predicting material properties and process control using advanced analytical approaches. The research will include both theoretical modelling and experimental work on the laboratory equipment for direct laser deposition (DLD) and selective laser melting (SLM) of metallic materials.

Main tasks of the candidate:

- Research and modelling of direct laser deposition and selective laser melting processes.
- Identification of key sensors and measurable variables for monitoring and diagnostics of LAM processes.
- Optimisation of process parameters to improve the quality and reproducibility of additive technologies.
- Optimisation and design of optimal material deposition paths with respect to the part geometry.
- Development of methods for predictive control of LAM processes.
- Development of machine learning algorithms for the analysis and optimisation of LAM processes.
- Experimental validation of the developed model on the laboratory equipment (industrial 3D printer LASERTEC 30 SLM and developed DLD system with 6-axis ABB robotic system).
- Preparation and publication of scientific papers in international journals and conference presentations.

Qualifications required:

- Completion of a Master's degree in Mechanical Engineering, Materials Science, Computer Science or related discipline.
- Basic knowledge of additive technologies and machine learning methods.
- Experience with programming tools such as Python, MATLAB and ANSYS.
- Active knowledge of English (written and oral).
- Ability to work independently in research and analytical thinking.
- Ability to write scientific papers and prepare publications.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

☒ **diplomska listina/potrdilo o zaključku študijskega programa** (*diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme*)

☒ **priloga k diplomii/ potrdilo o opravljenih obveznostih** (*official transcript of all the grades for study programme, with which the candidate has enrolled/will enroll in a doctoral degree programme*)

☒ **potrdilo o do sedaj opravljenih obveznostih z ocenami študijskega programa, s katerim se bo kandidat prijavil na študij** (*official transcript of all the grades the candidate has received so far for the study programme, with which the candidate will enroll to a doctoral degree programme*)

☐ **nagrade** (*awards (e.g. Prešeren Prize of the University of Ljubljana, Prešeren Prize of a University of Ljubljana member and/or another equivalent award)*)

☒ **bibliografija** (*bibliography*)

☒ **življenjepis** (*CV*)

☒ **motivacijsko pismo** (*motivation letter*)

☒ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)

☒ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)

☒ **priporočilno pismo** (*letter of recommendation*)

☐ **druge priloge** (*other attachments*)