Scholarship for Student/PhD student (Reference: D-PS-2022-3)

The Faculty of Mechanical Engineering at Silesian University of Technology, Gliwice Poland, hereby announces a scholarship competition for a student/PhD student in the research project entitled: "Deciphering laser-microstructure interaction in multicomponent alloys (DECLARMIMA)". The research project (UMO-2021/42/E/ST5/00339) is funded by the Narodowe Centrum Nauki (NCN) within the framework of SONATA BIS 11 competition .

Requirements of the candidate:

1. BSc degree /MSc degree in mechanical engineering, materials engineering, physics or a related discipline
2. Strong background in at least one of the following scientific areas: (1) Feature engineering, (3) Bayesian machine learning, (4) Functional materials, (5) Phase Field Models (6) Statistics and optimization techniques;
3. Programming skills in one of the following languages (e.g. Python, C++);
4. Good command of spoken and written English language;
5. Ability to work independently as well as work together in team.
6. Proven track record of scientific achievements in the sector of advanced machine learning. This is best portrayed by the role as a first author in a manuscript (accepted in a journal or submitted to a journal) in the field of machine learning (feature selection techniques such as PCC heat maps and PCA, ensemble machine learning, probabilistic models, data visualization). The verified knowledge of using TensorFlow Probability (TFP) library will be given a high importance.

Job description:

The powdered materials systems (Type B materials*) consisting of one/some/all of the elements of the system Al-Ni-Fe-Cr, and Sn-Ag-Cu-X (X =Zn, Bi, Ni) will be first utilized as the standard material system for the mesoscale phase field modeling of selective laser melting (SLM). After developing benchmark phase field models, the materials alloy systems will be expanded to include elements other than the abovementioned elements. However, the maximum number of components in the alloys for the present study will be equal to 4. Aspects such as spatter formation, pores and defects, inclusions, varying melt pool geometry etc. need to be additionally considered in the multiphysics model and the initial conditions for such phenomena will be borrowed from the experimental selective laser melting phenomena. The mesoscale phase field simulations employing thermodynamic tensor model for high dimensional materials tensor data of multicomponent alloys, will be utilized in the study of the microstructure evolution for the multiphase systems. These multiphysics mesoscale phase field models for 3D printing of multicomponent (both conventional and multi-principal element alloys) powdered alloys, reinforced with the data from nanoscale simulations and from SLM experiments , will be subjected to the featurization techniques. The (big) data constituted by the features from computational simulations and experiments will be used as the basis for constructing different Machine Learning (ML) models. The variations in the type of 3D printers, powder texture, purity of samples, and the experimental procedures will also be treated as an influential feature in the ML models. Obtaining sensing data from the experiments and using physically informed ML models, digital twins (DTs) will be constructed. The DTs will be utilized primarily in the tasks of uncertainty quantification and property/feature optimization of unknown physical parameters associated with the laser-microstructure interface during 3D printing. Secondly, the DTs will be utilized for the virtual design of 3D printed energy storage and functional materials such as batteries, fuel cells, thermoelectric materials and shape memory alloys.

***Within the framework of DECLARMIMA project, there are two categories of materials in initial state: Type A – solid multicomponent alloys, Type B –powdered mulitcomponent alloys**

The main tasks for the PhD student:

1. Collect data and featurize multicomponent alloys (including but not limited to Sn-Ag-Cu-X , Al-Ni-Fe-Cr, Ti-based alloys, YSZ supported Ni- or Co- based alloys) of Type-B category.
2. Perform scale bridging multi-physics simulations,including phase field models for selective laser melting (SLM), and tally them with available experimental data.
3. Construct machine learning models from integrated computational and experimental datasets for SLM phenomena.

4. Develop physics informed digital twin for uncertainty quantification at the laser-microstructure interface; and in studying the 3D printed energy storage materials and functional materials.
5. Perform SLM experiments in order to cross validate the compatibility of the experimental data with the multiscale simulations data;
6. Contribute to the publications of peer-reviewed articles in reputed scientific journals.

NCN call for proposals type: SONATA BIS - ST

Deadline for submission of tenders: 05.12.2022

Form of tender submission: email

Terms of Employment:

Place of work: Faculty of Mechanical Engineering, Silesian University of Technology, Gliwice,Poland.

Announcement of competition results: 09.12.2022

Number of position(s): 1

Duration of scholarship: 36 months

Working hours: Full time (40 h/week).

Date of commencement of employment: As soon as possible.

Amount of Scholarship: PLN 5,000 / month . We kindly request the applicant to read the NCN's announcement on exemption from income tax from the NCN research scholarship: https://www.ncn.gov.pl/en/aktualnosci/2021-12-30-stypendia-ncn-podatki

Additional Information:

Application procedure:

The application should contain the following documents/information:

1. CV including the following information (list of scientific achievements, a list of publications, conference presentations, awards and distinctions for scientific activity, software and data processing skills) ;

2. Copy of the Msc/BSc diploma or equivalent document or a document confirming the last year of master's studies;

3. Copy of the Msc/ BSc thesis abstract;

4. Application letter or letter of motivation (maximum 1 page);

5. Acronym for reference of this position (Reference: D-PS-2022-3).

In addition to the above documents, please prepare a document consisting of the following statement: "I consent to the processing of my personal data for the purpose of recruitment in accordance with Art. 6 sec. 1 letter a of the Regulation of the European Parliament and of the Council (EU) 2016/679 of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46 /EC (general regulation on data protection). "

Application document (all of the documents combined together in a single pdf file) in English should be sent electronically to the principle investigator of the project Dr. Anil Kunwar (e-mail address: anil.kunwar@polsl.pl). It is recommended to include the job reference (Reference: D-PS-2022-3) in the subject of the email message.