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Doctoral Candidate (DC7): Integration of additive manufacturing capabilities in the bioinspiration design process

Host Institution: Fraunhofer IWS, Germany

Secondments: Product Development Research Group, University of Antwerp, Belgium (UA; 6 months)

University of Groningen, The Netherlands (RUG; 4 months)

About Nature4Nature

Bioinspiration (including biomimetics and biomimicry) develops novel materials, devices, and applications inspired by biological structures and strategies. However, the main obstacle preventing this field from achieving its goals derives from differences in tools, practices and viewpoints of its practitioners. The EU-funded Nature4Nature project brings biologists, engineers, designers and manufacturers together to deliver early-stage researchers (ESRs) teaching in a learning environment that connects the inspiration, integration and implementation aspects of the bioinspiration process to undertake the conceptual, methodological and practical challenges. To do so, the project will collectively focus on biological filtration mechanisms to explore, test and design high-throughput, clog-resisting filtration systems, which could ultimately alleviate the current problems facing aquatic environments.

Fraunhofer IWS

Fraunhofer IWS is known for innovations in laser and material science, especially in the field of Additive Manufacturing (comprising material know-how, process development, system technology development, simulation and quality assurance). Notably, IWS leads a number of projects focusing in the development of laser metal deposition nozzles, hybrid manufacturing and robotics for direct energy deposition, but is also working in relevant projects in the field of powder bed technologies (i.e. LPBF, Binder Jetting...) for copper alloys and novel medicine or space applications, among other topics. The fields of simulation and process chain optimization for all available AM technologies at Fraunhofer IWS, as well as biomimetics and design for AM are addressed in a further group within the Department Additive Manufacturing. Fraunhofer IWS offers its expertise in the transfer of AM applications to industry, i.e. particularly notable are the projects on improved durability of jet engines by means of fine interlocking structures, which were first used in a commercial aircrafts in 2018.

Project description

In an aquatic environment a wide-spread principle of collecting food particles is by filtration. Although this principle is found in almost all aquatic/marine animal groups, this project will concentrate on vertebrates, namely fish and birds. The animal filtration system will serve as model to derive a technical filtration system that should not be clogging when functional and can thereby inspire to improve existing industrial/technical filtration systems or inspire to develop new systems. Functional performance of biological structures is limited by scale dimensions and material characteristics.

The objective here is the evaluation of the effects of changes in these parameters by means of additive manufacturing (AM) technologies as it is crucial for the success of the bioinspiration transfer process. You will (1) experimentally validate the performance of structures manufactured by different AM methods, based on the models obtained by DC1 and (2) explore the opportunities that additive manufacturing offers for sustainable design, and to what extent additive manufacturing can support design for a circular economy. Initial results from DC4 may also serve as input for manufacturing development.

You will mainly be working at the Process Chain and Product Development group of the department of Additive Manufacturing and Surface Technologies at Fraunhofer IWS. The study of the general principles of additive manufacturing as well as the specific processes behind this term (e.g. DED, PBF, FFF, Printing, PJM, SL) and the associated process chains (e.g. heat treatments, mechanical processes, metrology, analytics, etc.) takes place in our facilities. During your first secondment in year 2 to Universiteit Antwerpen you will research green manufacturing technologies and evaluate implementation potential for bioinspired filtration designs. In your second secondment in year 3 you will experimentally validate different additively manufactured models of filters produced by multiple AM technologies and materials.

Profile & requirements

- Applicants must hold a master's degree or equivalent in the fields of Biology, (Applied) Physics or Mechanical Engineering
- Transcripts of the master's degree must be available by the start date
- Applicants should have a strong affinity with research on manufacturing technologies and biomechanics
- Applicants should have a strong affinity with CAD and data analysis
- The applicant has a basic knowledge of programming (e.g. MATLAB, Python, or other)
- Applicants may be of any nationality but must comply with the Horizon Europe MSCA eligibility criteria*
- Applicants must be able to understand and express themselves in both written and spoken English to a level that is sufficient for the completion of a PhD
- All qualified applicants, including minorities and woman, are encouraged to apply

* **HORIZON MSCA Mobility Rule:** Applicants must not have resided or carried out their main activity (work, studies, etc.) in the country of the host organization (Germany) for more than 12 months in the past 3 years immediately before the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status are not taken into account.

* **HORIZON MSCA eligibility criteria:** Applicants may not hold a doctoral degree or equivalent at the start date of the recruitment. Researchers who have successfully defended their doctoral thesis but who have not yet formally been awarded the doctoral degree will not be considered eligible.

Benefits

- The selected candidate will be employed by the host organisation for **36 months**
- **The start date will be as of September 1st, 2023**
- The opportunity to be part of an MSCA Doctoral Network: the selected candidate will benefit from the designed training programme offered by the host organisation and the Nature4Nature consortium.
- The selected candidate will participate in international secondments to other organisations within the Nature4Nature network.
- Doctoral candidates are offered a competitive remuneration in line with the MSCA Doctoral Networks salary scale (see PDF on website), and consists of a monthly *Living Allowance*, *Mobility Allowance* and *Family Allowance* (if applicable).
- Costs associated with the network and training events are to be covered by the host institution

Application

- Interested candidates are invited to apply for this position: <https://jobs.fraunhofer.de/job/Dresden-PhD-Student-%28mfd%29-MARIE-SK%C5%81ODOWSKA-CURIE-01277/906535701/>
- The closing date for applications is **March 31st, 2023**.
- The selection committee will review all the applications upon the application deadline.
- The recruitment process of Nature4Nature is in line with the principles set out in the [European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers](#).
- Ukrainian researchers are eligible to benefit from the Science4Refugees initiative without the need of holding the refugee status.

Additional information

- For more information on the Nature4Nature consortium, please visit our website at <https://www.nature4nature.net/>
- Any additional questions can be directed to the project manager, Genevieve Diedericks, at Genevieve.Diedericks@uantwerpen.be

