Postgraduate student of Polytechnic University about internship in Finland and new perspectives in the field of additive technologies

SPbPU postgraduate student Arseniy REPNIN studies additive technologies from the point of view of metallurgy at the Institute of Machinery, Materials, and Transport (IMM&T). As the young scientist puts it, metals science is an applied discipline about the relationships between the composition, structure and properties of metals. Arseniy explores this classic dependence within the framework of new technologies, i.e., additive technologies. In order to study this area in more detail, last January Arseniy REPNIN went for an internship at Lappeenranta-Lahti University of Technology (LUT, Finland). Unfortunately, during his visit to LUT, a coronavirus pandemic began in the world. Read in our interview about the research carried out in the new format, the remote mode, and the implementation of new ideas.

- Arseny, glad to see you! Ls tell us when the idea came up to go to Lappeenranta-Lahti University of Technology?

- Additive technologies are a new field, and there are various lines of research in

it. To explore this area more effectively, you need to have an understanding of its various aspects. An excellent opportunity to look at the subject under study in a new way is cooperation with foreign scientists. Since Polytechnic University has a well-developed international activity, I began to study academic mobility programs and tapped into Erasmus+. I analyzed partner universities and chose LUT.

- And what was the reason for that choice?

- First, LUT has been actively involved in scientific research in the field of additive technologies for a long time. Second, our universities have already cooperated in this area. A nice plus to the above reasons for choosing a university was its close location to St. Petersburg.

- What is your internship about?

- My internship is aimed at sharing knowledge in the field of additive technologies. Again, this is a new line of study that has many different aspects. Now the situation is as follows: universities focus on specific areas and conduct research on them. The more research is done, the more it becomes clear that there is a relationship between various aspects of additive technologies. If you combine the results of developments from separate areas, you get a synergistic effect. And this is a direct road to creating new research trends.

- You have arrived in Finland and the news channels are starting to broadcast about the coronavirus pandemic. What decision did you make: stay in Lappeenranta, or return to Russia?

- The pandemic started in the middle of my internship. Finland responded promptly and correctly to the situation. In this regard, there was no strong spread of the virus. However, a number of restrictions were introduced, including the closure of universities. This affected the work and learning processes. But it should be noted that initially LUT paid great attention to distance learning, so students and staff quickly adapted to the new way of life. Since there was no strong spread of the virus in Finland, after a while the university was reopened, and I was able to continue my research. In particular, I took up the practical part, which I could not start on time due to coronavirus.

- How did your research work go during the pandemic?

- We had the opportunity to do science even in times of limitation. It's true that my role in terms of research has changed. If initially I had to prepare and carry out a plan for an experiment, then during the pandemic my responsibilities became more managerial. In this way, I remotely controlled the conduct of the experiment. Some parts of it, by the way, are still going on today.

- What other surprises did you encounter during the internship?

- There was a specific situation: the professor who was the head of a research group on additive technologies, unexpectedly transferred to another university. And my research was carried out just in conjunction with his group. Unfortunately, staff changes had an impact on the timing of the research. It should be noted that LUT solved organizational issues quite quickly. The new head of the research group gave me full support and accelerated some of the experiments to compensate for the delay.

- What are the impressions from the internship at LUT?

- I am very glad that SPbPU and Lappeenranta-Lahti University of Technology are strategic partners. Thanks to well-established contacts between scientists, I have the opportunity to conduct a dynamic scientific activity. I am very impressed by the resources of the LUT laboratory complex. Its availability in terms of conducting experiments made it possible to carry out a series of important studies.

- Is it not secret? Can you share a few examples?

- Research has focused on the practical application of additive technologies. One work involved the use of computer simulation (modeling) of an additive process. Computer simulation can significantly reduce production costs, since the

probability of rejects is minimized, and the process itself is optimized. Modeling an additive process is an extremely difficult task. To reduce the consumed resources, various types of simplification are applied, which reduces the accuracy of the simulation. In addition, the complexity of the geometry affects accuracy. It was important for us to conduct a comprehensive analysis of the impact of geometry and different modeling approaches on the simulation accuracy. Its results will allow to reveal the potential of additive technologies to a greater extent.

The second work was related to the optimization of the process of manufacturing products by the method of additive technologies, namely, with a decrease in subsequent mechanical processing, which greatly lengthens the production and increases the cost of products. This is planned to be done by analyzing the influence of special technological elements - supporting structures - on the mechanical properties of the manufactured products. This study requires complex production operations to be carried out on the basis of LUT.

- How do you evaluate your results? Did you manage to acomplish the tasks?

- In my opinion, my participation in the Erasmus + program was successful both in terms of acquiring new knowledge and skills, and in establishing scientific and technical links. The assigned tasks were solved almost in full, although with minor shifts in time. During the internship, we planned to write articles on the research carried out. But due to the delay, some of the experiments are still ongoing. Nevertheless, we plan to publish both works in peer-reviewed foreign scientific journals.

- Arseniy, what general prospects do you recon based on cooperation with LUT?

- Taking into account the established relations, we aim to continue joint scientific work. So, in the near future we plan to hold a joint meeting with LUT employees to discuss scientific and technical cooperation in the field of additive technologies. Perhaps it will be possible to discuss academic interaction too, e.g., internships, double degree programs, and so on.

- Arseny, thank you for the interesting interview! We wish you new discoveries and success!

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