Natalia Lishchenko

Technology Centre:	PEM Gateway
Academic Mentor:	Dr. Garret O'Donnell
Company Partner:	Stoney CNC LTD
Company Mentor:	Dr. Rory Stoney

Dr. Lishchenko has completed her Bachelor's degree (included in master program), Master's Degree (1994-1999) in Metal cutting machine tools and systems (specialization 'Metrology, standardization and product certification') at Odessa National Polytechnic University (Ukraine), and Candidate of Science (2006) in Mechanical Engineering Technology at Odessa National Polytechnic University (Ukraine). In 2018, she graduated with Higher Doctorate degree (2018) in Mechanical Engineering Technology at National Technical University, Kharkiv polytechnic Institute (Ukraine) with a thesis entitled "Profile grinding productivity increasing on CNC machine on the basis of grinding systems element adaptation". Natalia has experience of working as a metrologist at a leading enterprise in Ukraine for the production of ball screws for CNC machines which allowed her to get acquainted with the production and technological processes of manufacturing parts, modern methods of assessing the quality of manufactured products, and gain skills in solving technical problems.

Natalia worked as Lecturer at Department of Electromechanics, Mechatronics and Engineering Graphics, Faculty of Computer Science and Automation, Odessa National Academy of Food Technologist (2007-2021) (Ukraine) and Department of Mechanical Engineering Technology, Odessa National Polytechnic University (2011-2014) (Ukraine). Also, she worked as metrologist at Open Joint Stock Company MICRON (2002-2007) (Ukraine).

Dr. Garret O' Donnell

Dr. O' Donnell is Associate Professor of the Department of Mechanical, Manufacturing and Biomedical Engineering at the Trinity College Dublin. His research activities are based on advancing the scientific understanding underpinning advanced manufacturing technologies in sectors such as medical devices, automotive and aerospace sectors. He is a principal investigator of the STAM Research group which consists of multi-disciplinary team focused on developing and implementing Manufacturing innovation. Research of STAM Group within TCD demonstrates of how to engage with industry where STAM Group has a strong record in industry supported projects ranging from EI Innovation partnerships, AMBER targeted projects, DTIF funding, FP7, and a number of previously funded IRC Enterprise partnership supported PhD students as well as IRC Enterprise partnership Post Doc researchers. The caliber of the research group is at the highest level internationally and a metric of international esteem is that Dr. O Donnell is an associate member of The International Academy of Production Engineering (CIRP). Dr. O'Donnell is an Associated Investigator with the Advanced Materials and BioEngineering Research (AMBER) centre at Trinity College. A key characteristic of Dr. O'Donnell's group is the strong links to partnerships and supporting partnerships in addressing next generation challenges such as "Industry 4.0".

Dr. Rory Stoney

The company is led by Dr. Rory Stoney who holds a PhD in sensors for machining and therefore is perfectly positioned for the role of secondment mentor. From his research days in TCD, he was collaborating with postdocs in the group and also postdocs in German research groups so he has a good understanding of working with scientists. He knows the research group in TCD well as he did his PhD there many years ago. In his research he also mentored younger PhD research students and have a good understanding how to develop and bring people strengths forward. Dr. Stoney manages a team of up to 10 currently in company. The Company team with Dr. Stoney understands the modern trends in machine tool technology that will help Irish SME compete internationally.

PEM Gateway

The PEM Gateway, based in the Institute of Technology Sligo, provides industry-focused research and development of precision engineering, manufacturing and materials, technologies and innovation. It works with companies at all stages of their research and innovation journey and across the full spectrum of Technology Readiness Levels. PEM provides engineering and technical solutions along with process improvements across the full product lifecycle, with specialisation in product design and development in the engineering and manufacturing sectors.

Host Institution - Trinity College Dublin (TCD)

TCD is Ireland's prestigious university offering degree and diploma courses at both undergraduate and postgraduate levels. All three faculties – Arts, Humanities and Social Sciences; Engineering, Mathematics and Science; and Health Sciences provide quality education. Research is one of the key factors that make TCD the leading university in Ireland and university of international standing. TCD promotes academic innovation and advising in the presence of appropriate centers at each faculty and state-of-the-art facilities allowing conducting modern research.

StoneyCNC Ltd.

The company designs and builds CNC machine tools and offers CNC solutions for a wide range of customers. StoneyCNC LTD is a growing company with a big potential, has full workshop and technical resources for CNC control development, connecting sensors, and embedding algorithms for process monitoring. Collaboration with TCD will be a transformational opportunity for the Company to develop intensively and become more and more competitive internationally.

StoneyCNC LTD is a company that implements advanced research, for example, the development of diagnostic and monitoring systems, the embedding smarter function into the control for technological operation diagnosing, the development a connectivity tool that would allow to have remove web based access to CNC control platform. There are no others CNC machine builders in Ireland so the Company has a unique opportunity to implement online monitoring algorithms.

StoneyCNC views work in monitoring as a key game changer for their own products and see wider potential is using their monitoring approach for large CNC machine tools.

The Company understands that successful projects require close collaboration between industry and science, bringing the big value to both parties involved. At the same time, dedicated office/lab facilities and the necessary technical equipment will contribute to the project progress.

Natalia's project

"Data driven optimization of complex-shaped parts produced by grinding and abrasive processes"

People's lives are being impacted every day by the work we do in developing, investigating and researching manufacturing processes and machine tools. Sometimes patients are surprised to find out that the technology and equipment that is used to make a medical implant is similar to that used make aeroengines, or aircraft landing gear.

And people are surprised to hear that we are trying to make machines 'feel' so that they can make this life changing components better, faster, more reliably and cheaper. This application area is a new and exciting space for me to focus my core expertise in monitoring of machining and abrasive processes. For example, during both the implants and machine parts finishing machining, the same technological difficulties arise, increased local temperatures in the cutting or grinding zone lead to the grinding burns and cracks. These defects lead to wear during use and even its failure. Hence the core challenge is how to measure temperature during the process – but we cannot measure these using sensors due to practical access limitation, so we need models based on manufacturing process physics. Here lies the core of my work-building monitoring solution for advanced manufacturing process using a combination of sensors, machine data and models.

Operation monitoring can increase the performance of machining through avoidance and compensation for the operation disturbances while the measured process quantities obtained with the monitoring system can also be used for optimizing the process. We are making the core foundation for data driven robust process supervision.

The purpose of the project is to develop tools that allow for data driven decision making in grinding and machining, and therefore increase the productivity of defect-free grinding of complex shaped parts (for example, parts like biomedical implants). This approach intended will take advantage of the increase in available digital data at the preproduction CADCAM stage, in-process through online monitoring as well as dimensional inspection.

To be able to do this effectively one needs to have excellent understanding of the processes of machining and one needs to have strong partners such as StoneyCNC to support integration, and collaborators such as TCD, and the PEM Gateway to support with the context and technical work.