Jury Report
Tata Steel Graduation Award for Mechanical Engineering and Materials Science 2020

G. (Gaweł) Kuś MSc, TU Delft
Quantum Gaussian Processes for data-driven design of metamaterials

Seven MSc theses were submitted this year for the TATA Steel Award for Mechanical Engineering and Materials Science. The jury is very pleased with the high level of the submitted theses, representing the field in its full width: from solid mechanics to fluid dynamics, from thermodynamics to design, construction and control, covering applications from atomic levels to large infrastructures. They reflect the impressive quality of the mechanical and materials science education and research at our Dutch universities. The selection of a winner was not a simple task due to the excellent quality of the nominated candidates. After careful considerations, the jury unanimously decided to award the 2020 Tata Steel Prize to Gaweł Kuś, a graduate of the Faculty of Aerospace Engineering at Delft University of Technology, within the chair of Novel Aerospace Materials.

Gaweł Kuś completed his BSc and MSc in Aerospace Engineering in five years and four months, both "cum laude". His MSc thesis was exceptionally awarded the highest possible mark, a 10, with the remarkable comment from the external committee member from the Mathematics department that he would have been awarded the same grade if he would have graduated in Mathematics.

He worked on the topic of Quantum Gaussian Processes for Data-Driven Design of materials – a completely new subject for all involved. It combined three challenging scientific topics all at the very forefront of modern science: quantum computing, meta-materials and sparse Gaussian processes (a Bayesian machine learning method), each of which would have been complex enough for a very demanding MSc project. His thesis demonstrates his deep understanding and mastering of all topics involved and his ability to create a theoretical foundation for quantum computing based artificial intelligence applied to materials design. Gaweł Kuś showed under which conditions quantum computing and sparse Gaussian processes would outperform conventional supercomputers by breaking the 'curse of dimensionality' for multi-parameter optimization problems. He elegantly demonstrated some of the possibilities of the new conceptual framework to transform stiff materials, such as metal, into elastically deformable and super-compressible metamaterials. Not only did his research reveal that the proposed quantum machine learning algorithm can be more scalable than deep neural networks, he also made the first application of this new algorithm to design a metamaterial with important implications for different industries, including the steel industry. A manuscript based on his work is now being considered for publication in the prestigious journal "Quantum Machine Intelligence".

Mr Kuś wrote his own research proposal submitted to the ESA Science Innovation program, which was granted, through which he is now an ESA funded PhD student at TU Delft, thus engaging outstanding young talent in the field of space related research.

Taking all considerations into account, the jury is of the opinion that Gaweł Kuś is the worthy and justified winner of the Tata Steel Prize, the Young Talent Graduation Award for Mechanical Engineering and Materials Science 2020.

Prof. dr. ir. R. (Remko) Akkerman, Full Professor Production Technology University of Twente
Prof. dr. ir. M.G.D. (Marc) Geers, Full Professor Mechanical Engineering Eindhoven University of Technology

The jury meeting took place 27 October 2020, was chaired by Ir. A. (Bert) Meerstadt MBA, Director KHMW, and also attended by Prof. dr. A.P. (Ad) IJzerman, Secretary of Natural Sciences KHMW and Drs. S. (Saskia) van Manen, Secretary (minutes).