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The next generation in additive manufacturing technology is being developed in Technobothnia

A newly started project is now further developing the capacity for using robotic arms in additive manufacturing (AM). This novel technology may be of great interest for the Vaasa-region in the future.

In AM, 3D objects are formed layer by layer by adding material in a computer-controlled process. A more well-known term for AM is perhaps 3D printing. The rapid development of AM technology during the past 15 years means that AM now is on the verge to become an industrially very significant manufacturing technology, either as a complement to traditional manufacturing or sometimes as a replacing technology.

<u>Convenient benefits</u>

The benefits of using AM are many. One is that it allows for geometry optimisation and manufacturing of objects with a geometry that has previously been impossible. Another is the (perhaps even disruptive) concept that in the future, a purchaser in need of new equipment or spare parts perhaps no longer have them delivered to the door from a supplied. Rather, the purchaser simply acquires the drawings needed to print them, and thereafter manufacture them in any conveniently located 3D-printer. A third benefit is also that AM typically does not create material waste.

<u>Challenges with AM</u>

There are, of course, also many challenges associated with “traditional” AM or 3D-prinitng. For instance, the maximal size of an object that can be printed is directly determined by (the typically moderate) size of the printer. Another is that the printing of a new object always has to start from a flat surface, and significant amounts of supporting material may therefore be needed. One way to increase the printable length of an object is print it onto a conveyor belt. Thereby, the length of the object becomes essentially unrestricted. However, the object still has to be printed with a flat surface as the starting point.

<u>Robotic additive manufacturing in Technobotnia</u>

Alternatively, if the printer is placed on a robotic arm, sizeable objects can be printed onto basically any 3D shape instead of only a flat surface. This technology is currently being developed in the Technobothnia Education and Research Centre, using a six-axis industrial robotic arm. This development is made possible through funding from the European Regional Development Fund (ERDF), and takes place within the Technobothnia Robotic Additive Manufacturing Center of Excellence (TB-RAM CoE) project. This is, in turn, carried out as a cooperation between Novia University of Applied Sciences, Vasa University, and VAMK University of Applied Sciences.

<u>Development activities and setup</u>

The project focuses on large scale 3D printing and purpose design model optimisation. The chosen AM technology is material extrusion with a range of thermoplastic materials (ABS, PLA, Nylon etc.). During the project a series of tests will be carried to explore the material behaviour with various extruder nozzle sizes, temperatures, printer speeds, etc. The extruder is made from parts sourced from a RepRap Mendel type 3D-printer, which are attached to a 3D-printed frame that connects it to a mounting plate on the robotic arm. The robot used is an IRB-1200 90/5 from ABB. The different elements mounted in the tool are programmed using Arduino software, and the software developed for the robot in Rapid code (responsible for the G-code translation).

Local benefits

Whereas RAM certainly is a cutting-edge technology, and while there is a need for technological development, as well as internal competence building during the project, the focus of the project is on (external) regional development in the long run. One objective is to create demonstrations that can be implemented easily, on a short notice, so that for instance companies interested in this technique can come to Technobothnia and get acquainted with it. Another objective is to integrate this technology into the teaching, and thereby supply the region with future experts. A third objective is to evaluate how companies in the future can obtain prototypes from Technobothnia, either by purchasing them directly or by utilising the equipment themselves for prototype production. In order to achieve these objectives, external input is very valuable and, in fact, essentially crucial. The authors therefore welcome anyone, with any type of interest in this technology, to contact us. Your contribution will be valuable!

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