SAM|XL
SMART ADVANCED MANUFACTURING

Delft
Fulltime
Master

Aerospace (structures & materials)
Analytical

Apply by sending an email to communication-samxl@tudelft.nl with your resume and motivation letter.

Robotic Motion Planning for Mesh Reconstruction

1.1 Problem Statement

The manufacturing processes in the aerospace industry are characterized by high-mix low-volume manufacturing. This often makes it infeasible to automate the processes due to the costs and time needed to create specific programs for new variants of parts. This can be troublesome especially for heavy and/or repetitive tasks, such as drilling and joining of composite panels to form aerodynamic surfaces, satellite casings or other parts.

As a result there is a strong need for a more flexible use of robotized processes, where the robot trajectory is calculated based on input from sensors and general process information. These more flexible processes not only allow a more diverse range of parts to be processed, but are also less dependent on the exact placement of the part w.r.t. to the robot.

Within SAM|XL we are working on building the flexible robotized processed described above for the aerospace industry. The first step in this process is finding the object of interest and reconstructing a mesh based on the sensor data received from a 3D camera. In the steps thereafter this mesh is used to plan the path and trajectory of the robot to perform the actual process.

To recreate an accurate and complete mesh, the robot has to take multiple pictures and stich these together. The viewpoints and therefore robot poses at which the pictures have to be taken is dependent on the part and its geometry. The current approach to gather the data required for the mesh reconstruction is to use pre-programmed routines from which the operator can choose. An more optimal approach would be if the robot is able to determine its next viewpoint and robot pose based on the obtained data and the regions in which there is a lack of data. Ideally this would reduce the time spend scanning the object, reduce the amount of pictures taken and improve the quality of the reconstructed mesh.

1.2 Goal

The goal of the graduation assignment is to create an framework which is able to generate and optimize the robot motion in order to reduce the amount of samples taken and improve the quality of the reconstructed mesh with respect to pre-programmed routines. Possible approaches include, but is not limited to, machine learning and information theory. It is encouraged to implement the developed framework on the real robotic systems available at SAM|XL.

About SAM|XL

Smart Advanced Manufacturing XL, or SAM|XL, is a collaborative research centre at the TU Delft Campus setup as a non-profit foundation with an innovation community. We focus on automated production processes of real-world-size, lightweight structures made of exotic materials with tight tolerances. Our solutions find their way into high-tech sectors such as aerospace, maritime and wind-energy. We work with the latest robotic and automation technology and endeavour to apply our knowledge of high-tech automation to hard problems coming from these sectors.

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