Geometric Optimization of 3D Printed Assemblies

PROJECT DESCRIPTION

"Additive Manufacturing (AM) or 3D printing is a manufacturing technology which uses CAD models to manufacture solid parts. The manufacturing from CAD models is done by deposition of material in a layer-by-layer process in a dedicated machine with a number of techniques. AM has become a popular technique in manufacturing of prototypes, visual or functional parts in a minimum amount of time and cost. However, the printing of assemblies on a 3D printer is never researched from a geometrical point of view; this will not only help to print the assemblies directly but also reduce the assembly time and effort.

Although AM has become popular, there are many areas of improvements. The properties of the parts manufactured with additive manufacturing depend on a large number of machine and process variables. This leads to variations in the output geometry of the printed part, and makes it difficult to assemble. The objective of this project is to investigate the effect of parameters on geometrical properties of assembly models printed using DLP (Digital Light Processing) and FDM (Fused Deposition Modeling). Dedicated GD&T drawings will be made for the assembly test prices so that the geometrical output of the parts can be studied. An assembly test piece will be designed for this and a statistical analysis will be conducted to find significant variables and the output characteristics. These results will be further analysed to do predictive modeling of the output geometrical properties and a compensation tool will be developed to incorporate these variations into the initial stage of the printing to mitigate variations and to obtain accurate parts and assemblies. The fit and function analysis of the assemblies will also be done to ensure proper functionality of the mechanism. The data generated will be further used to do tolerance analysis on the assembly parts to calculate the process capability of the printer and to assign the limits for the tolerance values of that particular printer. Finally, a case study will be done to validate the above experimentation and modeling results. This will make the printer useful for further assembly printings with full form and function.

- Student should be from mechanical engineering, industrial engineering, manufacturing engineering, or mechanics engineering domain.

- Good understanding and background in engineering drawing and design, manufacturing processes is required.

- A basic understanding of process and working of 3D priniting is required.

- Software skills required: Solidworks or Autodesk Inventor, MATLAB (or Mathematica)

- Practical skills: Experience with manufacturing processes or 3D printing projects, CMM.

- Other skills: Data analysis, Report writing, presentation, good communication and computer skills

Contact: Brendan Cavanagh, Internship Coordinator (Inbound)
University of Alberta International
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- Desirable skills (Not necessary): Knowledge of GD&T drawings, Tolerancing, mathematical modeling, experience with Laser scanners.

Student will be part of a large research team at Additive Design and Manufacturing Lab (ADaM Lab) at University of Alberta. Student will be required to conduct experimentation on the DLP and FDM printers available in the lab. The experimental setup, test pieces, experimental design will be chosen by the student and justified according to the need of the project. Student will undergo a basic Chemical safety, Lab safety and WHIMS certification to become eligible to do the experimentations in the lab. Student will be required to do a literature study on DLP printers and the geometrical optimization of the parts printed on DLP printers. Moreover, student will undergo basic training on the DLP printers to have an idea about the Standard Operating Procedure in the Lab and know-how to operate the printers.

Apart from this student will use Coordinate Measuring Machine to collect geometrical data on the printed parts. Data analysis tools and software's will be used here to organize and analyze the data according to the requirement of the project. Student will also use CAD for test piece design and drawings. Later on mathematical analysis and statistical softwares will be used by the student to interpret the data and reach a predictive model. During the entire internship period, student will be helped and guided by supervisor along with experienced graduate PhD student who already working on this research area. Finally, student is required to write down a project report and make a SOP for any new devices that the student will use. A project presentation is also expected from the student at the completion of the project.

FACULTY-DEPARTMENT

Engineering - Mechanical

DESIRED FIELD OF (STUDENT) STUDY

Mechanical or Industrial Engineering

INTERNSHIP LOCATION

University of Alberta Main Campus - Edmonton

NUMBER OF INTERNSHIP POSITIONS

2

INTERNSHIP START DATE

July 4

INTERNSHIP END DATE

3 months after the start date

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ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.

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