Geometry assurance: Utilization of Artificial Intelligence to Develop Geometric and Dimensional Tolerances (GD&T) From Product Functional Requirements

Background

A major task in the development of mechanical products is to define the geometric requirements of each part and the entire product. These requirements can directly affect the cost, functionality, quality, and durability of the product. Therefore, it is a main challenge of the developers to define them so that all functional requirements of the products are fulfilled while the production cost is minimal. This task is commonly very complex and case-dependent that it is performed through either trial and error or based on previous knowledge and experience.

This project aims to investigate and develop different machine learning and artificial intelligence techniques and methods to help developers in defining the GD&T based on the functional requirements of the product.

This project is conducted as a part of Digi-Q (Digital quality assurance for the sustainable industry) project that will be conducted by the companies: Volvo Cars, Saab, PolyWorks, Chalmers, RD&T Technology, and Fraunhofer-Chalmers Center. The main goal of this project is to realize a digital quality assurance process that can be scaled up and enable an efficient, sustainable and competitive global production.

The master thesis will be conducted in the Geometry Assurance Group in the Product Development Division of IMS. This group has been active in the field of robust design and geometric requirements for more than two decades and has collaborations with main Swedish industries.

Tasks

- Literature studies: The first task is to investigate the background of the problem, find if there are any systematic solutions for it, and get to know more about functional and geometric requirements.
- Developing skills in Machine Learning and AI: the student should either have previous knowledge of different tools and methods or will learn them through the project.
- Developing methods and tools to perform the task entirely or help the designer in performing the task.
- Apply the developed method in several sample cases to verify its performance.

Goals

- Gain a comprehensive background on methods of developing GD&T from functional requirements.
- Defining the limits and potentials of AI in GD&T development.
- Develop a tool or a method of designing GD&T from functional requirements.
- Verify the validity of the tools and methods presented.
- Suggest a plan for further developments of AI in robust design and geometry assurance.

Means

Office, computer, and software are available at Chalmers in Johanneberg Campus. The work will mainly be conducted at Chalmers.

This thesis work needs to be conducted by two students. The preliminary start is January 2022.

Information

Examiner and supervisor

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