RESEARCH TOPIC FOR THE PARISTECH/CSC PhD PROGRAM

Field: Information and Communication Sciences and Technologies

Subfield: Product engineering, Computer aided design, Virtual/Augmented Reality.

Title: Development of a design approach with real-time assembly information and an enriched CAD tool

ParisTech School: Arts et Métiers Sciences et Technologies

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Short description of possible research topics for a PhD:

In current project, designer and assembly/manufacturing expert work in a sequential manner on a 2D screen. Close collaboration is needed between project stakeholders, as well as more **interaction** and **dynamic** way of working. At mean while the augmented and virtual reality (AR & VR) technologies became more and more widespread in industry for assisting various engineering activities. It is evident to ask whether AR & VR can assist designers by enriching current CAD tools.

The **Design For X** (DFX) tools need then to be implemented in the AR or VR application to give information of **X** in real-time. The 3D computer model displayed on the screen of CAD software will be used to compute and analyze assembly process to propose suggestions for decision making. For instance, in Design For Assembly method (DFA), a model can be set and specific algorithm using mereotopology could enable checking the consistency of the assembly sequence, highlighting the interfaces and showing the swept volume of the part move during a sequence.

Therefore, the thesis objective is to devise, prototype and experiment a digital tool allowing real-time processing of **Computer-Aided Design** (CAD). This development will be clearly seen as a **virtual whisper** to the designer. The integration of real-time expert knowledge to the designer enables the reduction of product development time, as less iteration between project stakeholders. As such, a new design approach in required.

Required background of the student:

Product design, computer aided design, product lifecycle, DFX methods, computer science, augmented reality

A list of 5 (max.) representative publications of the group:

- **Perry, N**., Bernard, A., Laroche, F., and Pompidou, S. (2012). Improving design for recycling – Application to composites. CIRP Annals – Manufacturing Technology Elsevier
- **Gruhier, E**., Demoly, F., and Gomes, S. (2017). A spatiotemporal information management framework for product design and assembly process planning reconciliation. Computers in Industry, Vol. 90, pp. 17-41
- **Gruhier E**., Demoly F., Dutartre O., Abouddi S., Gomes S., A formal ontology-based spatiotemporal mereotopology for integrated assembly design and assembly sequence planning, Advanced Engineering Informatics, 29:495-512, 2015, doi10.1016/j.aei.2015.04.004
- B. Li, F. Segonds, C. Mateev, **R. Lou**, F. Merienne, Design in context of use: An experiment with a multi-view and multi-representation system for collaborative design, Computers in Industry, 103, pp. 28-37, 2018.