

## THESIS G-SCOP 2019

**Title:**

### **Knowledge Capture and Reuse for the Model-Based Design of Open Source Hardware**

**Phd school : IMEP2**

**Start date:** 1 October 2019

**Financements envisagés – Contexte – Partenaires éventuels :**

**H2020 OPEN!NEXT program:** The Collaborative Design group of G-SCOP laboratory is looking for a a PhD candidate to take active part in the Open!Next Horizon2020 European project. The project Open!Next – which gathers research centres (Grenoble INP/G-SCOP, TU Berlin, University of Bath), co-creation facilities (Fablab Berlin, Underbroen/Maker, Waag society, Dansk Design Center), product data management organisations (Fraunhofer IPK, Wikimedia DE, Wikifactory Ltd), and enterprises (OpcTec GmbH, Styjja, Sono Motors GmbH) – aims at enabling small and medium-sized enterprises to engage in company-community-collaboration for means of development and market exploitation of open source hardware products and related-services.

**Brief Description:**

The design of Open Source Hardware (OSH) product and related-services relies on the extensive use of models engineered with computer-aided technologies (MBSE, CAD, CAE, CFD, CAM, virtual and augmented reality, point clouds from 3D scanning, reverse engineering...).

Cloud-based open source platforms such as Wikifactory for hardware or GitHub for software enable open source communities to host and share engineering artefacts (code, models, bill of materials, assembly instructions, videos...), manage projects, and build open source products.

However, so far, the reuse of the design artefacts required to recreate or modify products is often challenging because most design knowledge (assumptions, rules, choices...) remains tacit knowledge (e.g. commonsense) or unrecognised knowledge (e.g. expertise and skill). When one access the repository of an open source project, the quantity of recognised and codified knowledge in models is relatively limited. Indeed, in most cases, the repository only includes a snapshot of the solution at a given time, that is, a set of models, codes, and documents without the underlying design rationales that conducted to the actual solution. The lack of organisation and traceability in the design process of open source hardware makes the reuse of models and the collaboration between companies and maker communities difficult. The OPEN!NEXT project ambitions to develop a platform based on Wikimedia technology that could guide and support the design communities through development standards and models for optimising the reuse of existing designs among and across the communities. The PhD candidate will take an active part in this effort in collaboration with the other involved partners.

The PhD candidate will conduct research on a framework to build project memories during the model-based design of open source hardware in order to facilitate design reuse. The framework will rely on methodological recommendations, computer-aided technologies, and experimental based-analysis research to capture and reuse knowledge. The main deliverable of this research project will be an ontological standard for the design of open source hardware and its related services, providing a precise characterization of the “source” of hardware. The framework will intend to blend the agility of makers community with the traceability processes of industrial companies so as to create the necessary conditions of an effective and efficient collaboration in creative and productive opens source hardware ecosystems.

#### Your profile

The PhD candidate should have an excellent Master's degree (or Engineer degree) in product design, industrial engineering, systems engineering, mechatronics, mechanical engineering or a related field. The ideal candidate should have a background in product design methodology, modelling and simulation, and/or knowledge engineering. Since the candidate will contribute to developing software prototypes, programming experience within Java, Python, C# or C++ is required. As part of a European project, we expect excellent communication and scientific writing skills in English as well as commitment to tight project schedules.

#### **Contact(s) :**

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