

## Proposition sujet de mémoire **2014 - 2015**

MASTER Recherche 2<sup>ème</sup> année

Management, Innovation, Technologie

spécialité « Génie industriel »

### **Virtual Reality environment for Disassembly sequences generation and optimisation**

#### **Description of the subject**

##### **Context:**

In today's global context, two main directions are critical for the industry: product manufacturing cost reduction and environment protection, and product recycling at its end-of-life. Since the late 80's it has been established that the Assembly/Disassembly (A/D) process represents generally almost 30% of the product cost. Therefore, it is important to design proper plans for product assembly – manufacturing and disassembly – recycling. More, a realistic A/D process modeling and simulation can improve design efficiency, reduce cost and increase the percentage of product recycling. Nowadays, VR environments have significantly evolved towards A/D simulation, highlighting new requirements for the preparation stages and their integration. However, the literature search carried out within the framework of our recent works shows that the existing platforms of simulation are often badly integrated in the Products Development Process (PDP). Certain approaches for the modelling of disassembly were proposed but they do not allow validating the approaches because they do not take account of the effective geometry of the parts constituting the mechanical assembly. Thus, we need to define mobility amongst the components by a set of intrinsic information of the contacts. We need also complete models, able to describe the allowed movements for components of a mechanical assembly for simulations and optimisation of Assembly/Disassembly (A/D) operations of *interactive*, *real-time* or *immersive* types.

##### **Aims of the study:**

In this context the objective of the proposed subject is to improve the A/D process simulation through better haptic devices integration. To this end, series of tests with 6 degrees of freedom (DOF) haptic device HAPTION VIRTLOSE have to be performed. The principal steps of the work are:

- to propose a method for planning and simulation of A/D operations based on LCA (Life Cycle Analysis) of the product,
- to establish a model from the method suggested allowing to lead to a disassembly tree based on a hierarchical analysis of the components constituting the product. The tree will allow generating sequences of disassembling. The model will be based on the Digital Mock-up (DMU) of the mechanical units.
- to propose a method for optimisation of the possible disassembly sequences via different criteria including lowest cost value, minimum time for disassembling etc.
- to validate the model, via its integration in a constrained virtual environment allowing the simulation of A/D operations within the framework of the existing data-processing environment, as its integration in the PDP for the purpose of lean design for disassembly.



Thus, the validation of the disassembly sequences will be a help for the designers enabling them to estimate the level until which the product can be disassembled in the initial stage of its design.

The proposed subject may continue in PHD studies after then in the frame of 3 years PERSYVAL Lab PHD scholarship.

### Co-operation with other researchers and research units

The proposed subject falls under a common set of themes of research, within the Work-package WP9, Task 9.1. “*Interaction and Manipulation within Virtual interactive Scenes*” of the European Infrastructure VISIONAIR (<http://www.infra-visionair.eu/>) and the Research actions, Authoring Augmented Reality (WP2), “*Real-time capture and simulation of the real world. Representation and editing of virtual prototypes. Natural interaction with the augmented world*” of the PERSYVAL Lab (<http://www.persyval-lab.org/index.html>)

- Quel parcours conseillez-vous : Product Development  
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- Pour mener à bien le stage, il est souhaitable de suivre en cours optionnels le (s) enseignement(s) suivant(s) :

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