**Designing Intelligent Manufacturing Systems through Human-Machine Cooperation Principles**

**Start date**

**Funding**

**Supervisors**

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<td>Damien Trentesaux, Professor</td>
<td>Marie-Pierre Lemoine, Research Engineer</td>
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<tr>
<td>Christine Chauvin, Professor</td>
<td>Lab-STICC UMR CNRS 6285</td>
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**Registration**

**Topic:**

- Cognitive Work Analysis (CWA) proposed by the Lab-STICC. It is considered to be one of the main methods taking human factors into account in the design of sociotechnical systems. This method will support the design of assistance systems in IMS according to Human current and future needs redefined by new technologies (Chauvin et al. 2015).
Human-Machine Cooperation principles (HMC) proposed by LAMIH. It provides precise models to identify and implement the best organization and task sharing between Humans and new technologies according to their respective current capabilities and capacities regarding current situation and type of task to perform (Pacaux-Lemoine et al., 2017; Guerin et al., 2012).

To ensure a generic use of the theoretical developments, the method designed within the PhD framework will be applied on three different IMS: a swarm of intelligent products (Fig. 1.a), a cobot system (Fig. 1.b) and a swarm of AGV. These three Artificial Self-Organized Systems (ASO) will be considered regarding the different adaptable or adaptive levels of automation they propose. They differ from each other in the kind of interaction they have with Human, with other machines and in their abilities to reach parts of the objectives of the process.

Figure 1: (a) Inter-university Workshop of Production (AIP PRIMECA) of the University of Valenciennes and (b) cobot of the University of South Brittany (Lorient).

The PhD student will be located on Valenciennes University but several trips are to be expected on University of Lorient in order to study and to benefit from the complementarities between CWA and HMC approaches. The result of the combination of both approaches will lead to design and apply a method supporting the identification of the necessary individual and cooperative abilities of Human and ASO, to reach together a common goal. Such identifications will lead to recommendation for the training of Human, the design of IMS and Human-Machine Interface.

The PhD student will also be led to conduct experiments with human operators on the three ASO, available in their real or simulated version in LAMIH and Lab-STICC, to validate the proposed method. The results stemming from PhD student research will be put as knowledge to be complementarily studied within the context of the SurferLab (www.surferlab.fr), which is a joint academic/industry research lab (UVHC (LAMIH), Bombardier Transport and Prosyst; I-trans, & CNRS labels), working on future innovation for transportation based on distributed intelligence.

Funding:

Supervision:

Skills / Candidate profile:
Candidature:

- One page CV
- Application letter in English revealing the motivation
- Two last years' Master or Engineering school transcripts and class ranking if possible
- Recommendation letter from professors concerned by the PhD thesis topic
- Any documents deemed useful by the candidate

Contact:

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Applications must be sent before end of November 2017 to: marie-pierre.lemoine@univ-valenciennes.fr.

References:

