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PROPOSITION DE POST-DOCTORAT

Intitulé : Optimization of satellite FAL (Final Assembly Line) integrating collaborative robotics systems

Référence : PDOC-DTIS-**2021-02**
(à rappeler dans toute correspondance)

Début du contrat :	**Date limite de candidature :** 15/042021

Durée : 12 mois, éventuellement renouvelable une fois - Salaire net : environ 25 k€ annuel

Mots clés

Collaborative robotics, Process optimization

Profil et compétences recherchées

Modeling and control of robotic systems and human-robot interactions, simulation of discrete-continuous systems, optimization, C/C++ programming

Présentation du projet post-doctoral, contexte et objectif

In recent years, the growing interest in small satellites has given rise to numerous space projects involving large constellations of several hundred small satellites. Some are used for telecommunications purposes (for example, the OneWeb project which wants to deploy a constellation of about 900 satellites to provide inexpensive broadband Internet); but the main application remains the observation of the Earth (projects of Planet Labs, Airbus with LION ...). These large constellations represent an ideal response to high revisit (i.e. the ability to photograph the same point on earth several times a day), a feature that is now essential to develop the data services market linked to space data (aid for precision agriculture, management of natural disasters, economic forecasting, autonomous driving). But these satellite constellations require the development of innovative design methods and mass production processes, at competitive costs and high performance.

In order to increase the productivity and traceability of the assembly/test operations required for the integration of these new generation nanosatellites, the implementation of collaborative robotic systems is investigated in the LiChIE project, led by Airbus Defense and Space, to which this post-doctoral project contributes. The aim is to optimize the industrial process which can use collaborative robotics. This optimization can be thought at different levels and in different objectives :

- high-level process planning such as machine placement, flow optimization, time and motion studies, and resource allocation;

- improvement of existing processes and workstations for productivity and ergonomic considerations;

- design of the most appropriate assistive robot (e.g., location of the base of the robot, choice of the assistive modes);

- advanced control of collaborative robots to anticipate the operator's needs.

To perform this optimization, quantitative indicators are requested to assess the collaborative robot contributions to the process. This indicators requires an in-depth analysis of the different tasks and parametric physical-functional models of the robotic systems and operators (e.g., dexterity, force capabilities, speed, precision) and of their different levels of interaction (e.g., simple/complex, effortless/strenuous, attention level).

Objectives of the Post-Doc activities:

- Identify the relevant use cases where the tasks are of different types and levels and are representative of the applicative context of the LiChIE project;

- Define the relevant indicators for a task, considering the potential uses of these indicators (e.g., process planning, ergonomic analysis, robot control);

- Develop effective set-based approaches to derive quantitative indicators while automatically managing modelling errors and uncertainties;

- Illustrate the relevance of the proposed indicators in various case studies such as collaborative robot selection and optimization of workstations.

Typical post-doc activities:

- Analysis of the relevant use cases and associated state of the art in the fields of process optimization, ergonomics, collaborative robotics;

- Development of scalable task, robot and human models and their associated constraints to tackle the computational cost/accuracy trade-off ; the aim is to ensure that the overall approach is applicable at different time scales (e.g., ms, s, min, hours, days);

- Development of efficient interval analysis methods to compute the set-based quantitative indicators for humans and robots and corresponding methods of exploiting the obtained sets to define ``union'' and ``intersection'' operators for human and robot capabilities;

- Experiments on a modular workbench.

Collaborations extérieures

INRIA, Airbus DS

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