Doctoral Dissertation

Doctoral Program in Computer and Control Engineering (31.th cycle)

Candidate: Stefano Trapani

Academic Supervisor: Prof. Marina Indri

Company Supervisor: Ing. Rosario Cassano

Title: Task Oriented Programming and Service Algorithms for Smart Robotic Cells

Abstract

The research activity presented in this thesis has been carried out within a PhD Project in Apprenticeship in collaboration with COMAU, co-funded by Regione Piemonte. The topics addressed in such a context are mainly related to Smart Factories and Industry 4.0, and are included in a wider research activity aimed at the conversion of standard production lines (e.g., in automotive context) into smart factories, without changing the initial layout of the line. This means that the introduction of new kinds of machinery and devices is not expected; any changes should be compatible with the current production line, avoiding too inva- sive, setup phases. In this scenario the research activity was divided into two main fields of research: 1) the development of a new programming paradigm, and 2) the development of advanced service algorithms.

The first topic aims at providing an offline programming methodology, which allows to (re-) program the robotic cell in a flexible way. The new approach should be able to provide the fast reprogramming of the production line, with possible relocation of machinery and resources, on the basis of the current conditions. Even if such approach is less flexible than the Flexible Manufacturing Systems, it is easily applicable to standard production lines.

The goal of the second topic is to develop advanced functionalities to be imple- mented in standard industrial manipulators. Also in this case the idea is to avoid deep changes in the robotic cell. In this way industrial robots that were initially developed to perform, more or less, the same activity for all their life, now they could be used in different contexts, and for new kinds of applications.