INTEGRATED DESIGN OF A ROBOTIC CELL FOR LASTS ROUGHING

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Abstract

The success of a product or an industry on the current market, led by globalization, is strictly connected to the industrial productive processes. Technology must add value to products, satisfying, at the same time, severe standard conditions and rigid economical restrictions.

First of all, industries have to express high productive volumes and high flexibility while market demand, more and more challenging and detailed, looks for a quick answer to its continuing and unpredictable evolution. At the same time, it’s essential to guarantee an excellent final products quality, minimizing process time and costs.

Many companies are consequently converting their production systems adopting robotic solutions, to achieve these ambitious goals. Industrial robotics is going to “stand alone” cells, realised as a complete, independent and compact environment, to be placed inside a firm as a tool machine.

Within a rigid and closed structure, anthropomorphic robots are programmed to carry out technological and manufacturing processes, often interacting with automatic feed systems or artificial vision tools.

In order to realise quick re-configurability and re-programmability, the cells layout has to be designed through a deep integration of different competences, starting from mechanical to electronic and programming skills.

In add the whole supply chain has actively to take part of the design process while final users represent the main reference at each step of the developing procedure.

The traditional design process of robotic cells is inadequate to satisfy these complex tasks, so new methodologies and instruments have to be found and improved.

The present paper deals with the design and development of an integrated methodology, based on three-dimensional modelling, behavioural simulation and off-line programming of a manufacturing robotic cell. Thanks to the close partnership between University and SIR S.p.A. - Modena, leader group in robot integration, a lasts roughing cell has been realised and the implemented method has been validated.

Lasts roughing represents a key operation in shoes manufacturing because it is one of the process final steps, after leather (or fabric) forming, cutting and sewing, realised to obtain a good gluing between lasts and soles. A roughing tool has to follow a very accurate path, maintaining a constant orientation respect to the free-form surface of the last, fixed on a striking plastic form.

Working together with diesinkers, suppliers and final users, the manufacturing process has been modelled and a 3D environment has been realised, in order to optimize robotic axis movements and to obtain a good envelops managing.

Integration between three-dimensional modelling instruments (as CAD, CAS, points clouds and NURBS modeller software), simulation and off-line programming instruments allows to achieve significant results, in order to increase roughing finishing and to reduce time-cycle.

Customization of a commercial off-line programming Graphic User Interface minimizes re-programming time dealing with roughing of different models and sizes.

The developed methodology has created a complete reference model in robotic cells manufacturing, increasing skills integration within the design team, allowing a better cell customization and reducing time and costs, both for producers and final users.