

Optimization of industrial robotic systems

The Robotics and Automation research group mainly focuses its research activity in improving the performance of industrial robotic systems, with particular attention on modelling and optimization of robotic manipulators and flexible work-cells.

One of the research topics is focused on the trajectory optimization of task-redundant manipulators (figure 1) performing tasks characterized by high vibrations and forces, such as deburring. The irregularities of the burr induce vibrations in the robot leading to a phenomenon called “chatter”, which brings bad finishing of the workpiece. Since the resonance frequency of the structure is configuration-dependent and the robot is task-redundant, it is possible to plan a robot’s trajectory in a way that minimizes chatter*. In addition, when more than one finishing operation is required on the same workpiece, the motion sequence can be optimized to minimize cycle time, while automatically generating via-points at the same time, to avoid interference between the robot and the piece.

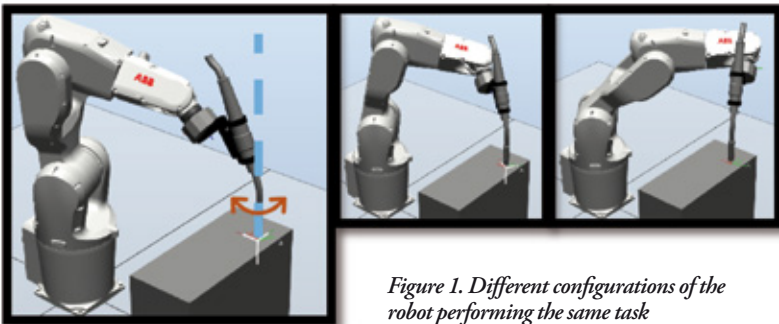


Figure 1. Different configurations of the robot performing the same task

Another hot topic in robotics is flexibility. We are currently studying new flexible feeders with drastically reduced retooling time, thus improving the productivity of the assembly line.

In particular, the vibratory behavior of a cylindrical object on an inclined vibratory plane has been modeled and tested (figure 2). The prototype of a full feeding system, including an industrial vision system and hoppers, is being developed, with the aim of optimizing the feed of common objects, such as screws.

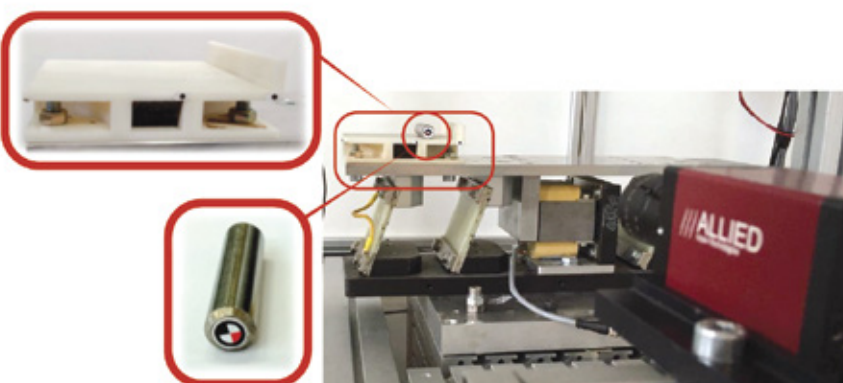


Figure 2. Experimental setup to study the behavior of a cylindrical part on a vibratory plane

* This research is carried out jointly with Alberto Doria, Matteo Massaro and Silvio Cocuzza.

Research topic:

Mechanical systems engineering

DII research group

Robotics and Automation



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Main research topics:

- Industrial manipulators
- Flexible robotic assembly
- Kinematic optimization
- Flexible part feeding
- Robot guidance
- Vision inspection
- Industry 4.0
- Collaborative robots