

Adaptation of a Task-Oriented Agile Workcell - Automatic Robot Taping

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PROJECT DESCRIPTION:

Motivation & Objectives

The process of taping (covering objects with masking tapes) before conducting surface treatments (such as plasma spraying and painting) is tedious and arduous. This project aims to do surface covering process using masking tapes with the introduction of an automatic robotic system and corresponding software algorithm. Researchers will delve into the design of the automatic system working with a robot manipulator, a rotating platform, a 3D scanner and specific taping end-effectors for this process. The taping process requires correct tape orientation and proper contact to attach the masking tape to the surface. Meanwhile, the taping path intending to cover the region of interests is introduced. In such taping solutions, the taping tool and the taping software can be combined to form a very useful taping package for the taping related industrial process such as plasma spraying, surface protection. Such taping solutions comprising of taping tool and taping software combined to form taping packages, can be commercialised for robot taping.

Methodology

The overall taping process is illustrated in Figure 1.

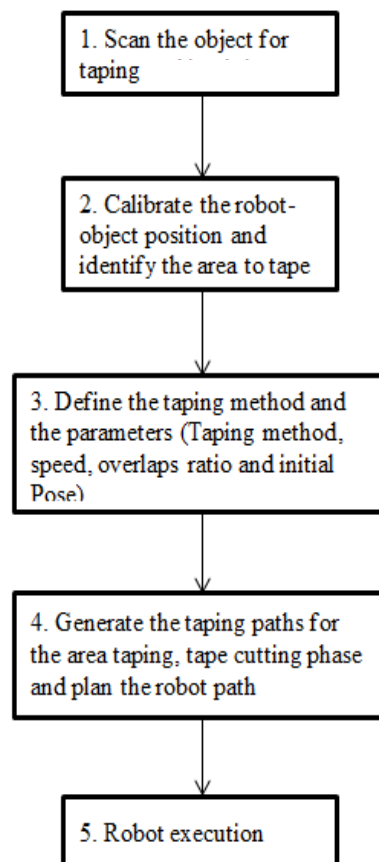


Figure 1: Working flow of the taping

In the automatic robot taping system, in order to realize the robot taping, a motion planning strategy based on the 3D digital model of the part to be taped is very crucial. This is because when it comes to repairing works; there is no standard CAD model of the broken part (due to deformation, breaks, losing of material etc.) As a result, a 3D scanning device is used to get the digital model. Meanwhile, having a useful end-effector to realize the taping motion is also crucial. The path planning of the taping process is certainly not trivial as there are many geometric constraints among the object surface such as the taping tool on the robot and the masking tapes during the taping process.

Taping tool: In this project, a taping tool with proper tape holding, guiding and attaching mechanism is designed to fulfill the task requirement. A cutting tool is used to separate the taping segments.

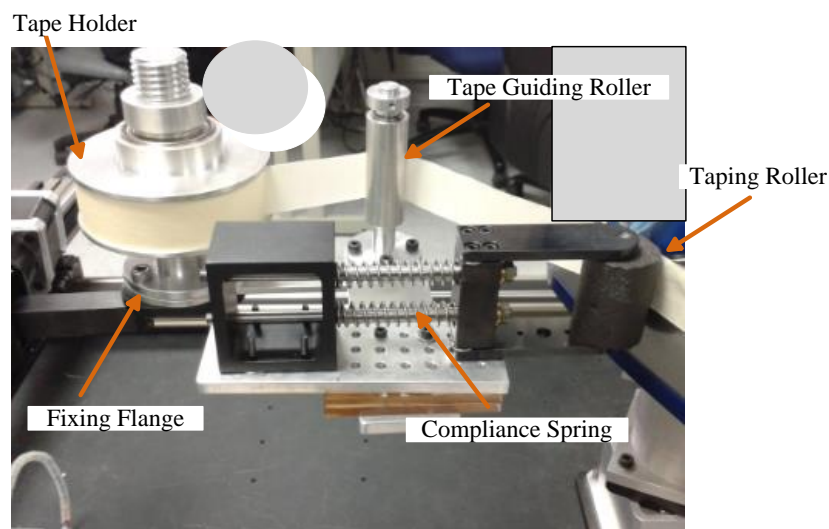


Figure 2: Taping Tool

3D Scanner: The scanner is used to get the 3D model of the object for taping. Path planning of the taping depends on it.

Software package: The corresponding software for taping utilised in this project enables the user to realize the automatic taping process. It includes:

- The acquisition of the digitized model based on the scanner and model editing.
- The selection and identification of area of interests for taping.
- The robot & platform path generation based on the planning strategy and the taping tool.

Results / Progress

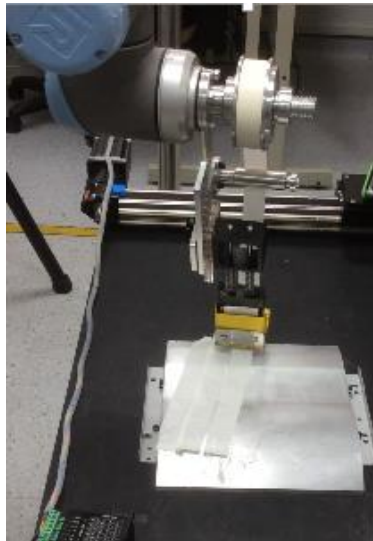


Figure 3: Taping Example

The robot system can execute the taping process based on the generated path.

GRANT:

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PUBLICATIONS:

Refereed Journal (Published/In Press):

- [1] Ming Chen, Qilong Yuan, Teguh Santoso Lembono, “Robot Taping: Taping System and Tapping Strategy”. Technical Disclosure (PAT/111/15/15/SG PRV).

Refereed Conference (Published/In Press):

- [1] Qilong Yuan, I-Ming Chen, Teguh Santoso Lembono, Automatic Calibration of Robotic Manipulator, Proceedings of 2014 IFTOMM Asian Conference on Mechanism And Machine Science, July 9–10, 2014, Tianjin, China
- [2] Qilong Yuan, Teguh Santoso Lembono, Yuhua Zou and I-Ming Chen, "Automatic Robot Taping: Auto-Path Planning and Manipulation," to be presented in Robotics, Automation and Mechatronics (RAM), 2015 8th IEEE Conference on.
- [3] Teguh Santoso Lembono, Qilong Yuan, Yuhua Zou, I-Ming Chen, “Automatic Robot Taping: System Integration”, in IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Korea, 2015.