

Automatic Multi-sensor Inspection Planning

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Introduction

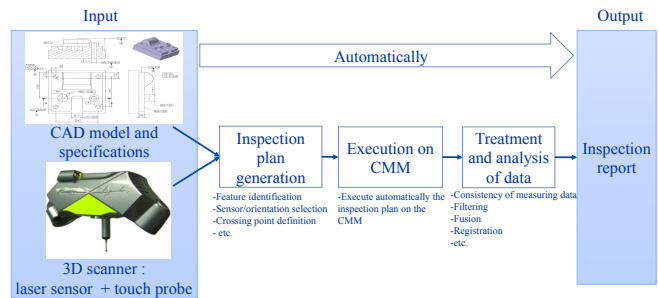
Verification of part conformance related to ISO specifications

- Measurement with a touch probe:
 - ✓ Good repeatability, high accuracy.
 - ❖ Few measuring points & long measuring time
- Measurement with a laser sensor:
 - ✓ Short measurement time & high density of points;
 - ❖ Measuring noise, heterogeneity.

Combination of the two sensors

The laser sensor is the first option.
Otherwise, the touch probe is used.

Global approach



How to generate inspection plan?

Recognition of inspection data

- Identify all the inspection features from the CAD model.

Scanner orientation identification

- Propose a first list of scanner orientations based on the principal orientations of the CMM.

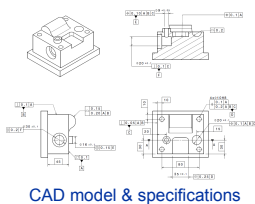
Operation sequence generation :

- For each orientation, selection of the suitable sensor for each feature according to accessibility and quality criteria.

Path definition

- Define laser path, probe path and optimized scanner path.

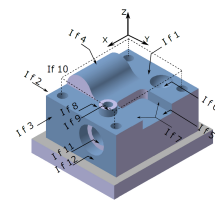
Methodology



CAD model & specifications

1/ Inspection data recognition

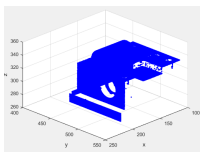
- Analyse the CAD model
 - Part = inspection features + non-inspection features.
 - Inspection Feature = measuring features + specifications.



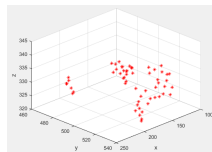
Inspection features

5/ Inspection range execution

- Execute sensor paths
- Extract point clouds



Measurement with laser sensor

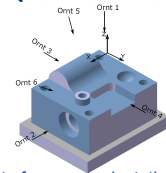


Measurement with touch probe



2/ Scanner orientation identification

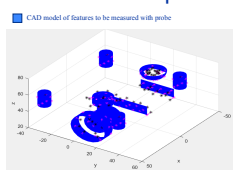
- Analyse the accessibility of both sensors according to the principal orientations {Z-, X+, X-, Y+, Y-},



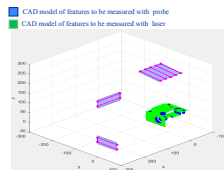
List of scanner orientations

4/ Path planning

- For each considered orientation:
 - Laser path for list 1
 - Probe path for list 2



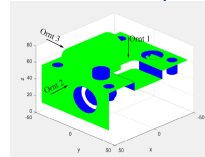
Touch probe paths



Laser sensor paths

3/ Operation sequence generation

- For each considered orientation,
 - Laser sensor ability => list 1 of measured features
 - Touch probe => list 2 of measured features



Green : measured with laser sensor
Blue: measured with touch probe

Scanner Orientation	Used sensor	Measured features /portions
Omt 1	Laser	IF1, IF4, IF5 and Portion of IF6
Omt 1	Probe	Portion of IF6, IF7, IF8, IF9 and IF10
Omt 2	Laser	IF3
Omt 2	Probe	IF11 and IF12
Omt 3	Laser	IF2
Omt 3	Probe	-

Operation sequences