Towards the fitting of parametric 2D sketches and 3D CAD models to point clouds of digitized mechanical assemblies for Reverse Engineering applications

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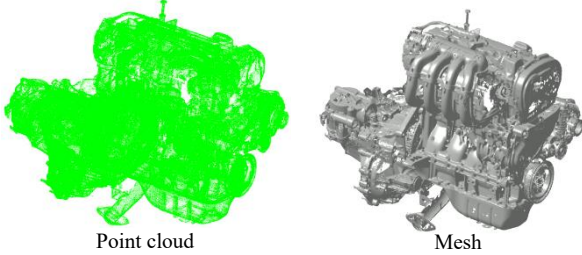[1]Arts et Métiers, LISPEN EA 7515, HeSam, Aix-en-Provence, France
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1 Research question

How to reconstruct a CAD part/assembly by segmenting a point cloud of a mechanical assembly?
- To allow "as built" verifications of tolerances, without disassembly, etc.
- To reconstruct parametric CAD parts/assemblies without patch by patch fitting.
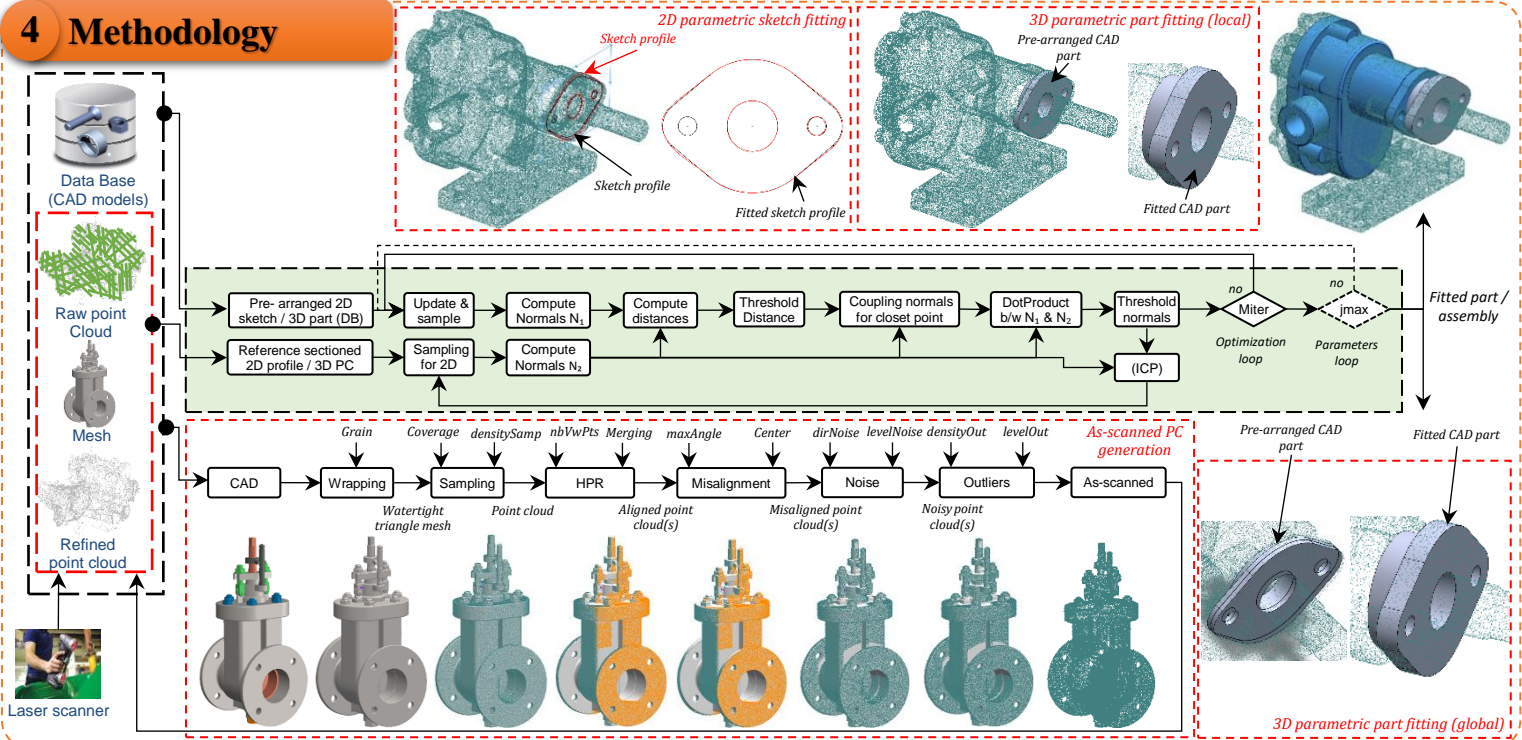

Point cloud   Mesh

2 Scientific challenges

- Avoid patch-by-patch fitting approach (Patch decomposition, trimming, stitching issues).
- Reduce tedious and time-consuming manipulations.
- Efficient reconstruction of editable CAD parts/assemblies.

3 Objective

- Make use of parametrized CAD models coming from an existing database or starting from a rough sketch to be fitted in the point cloud of an assembly.
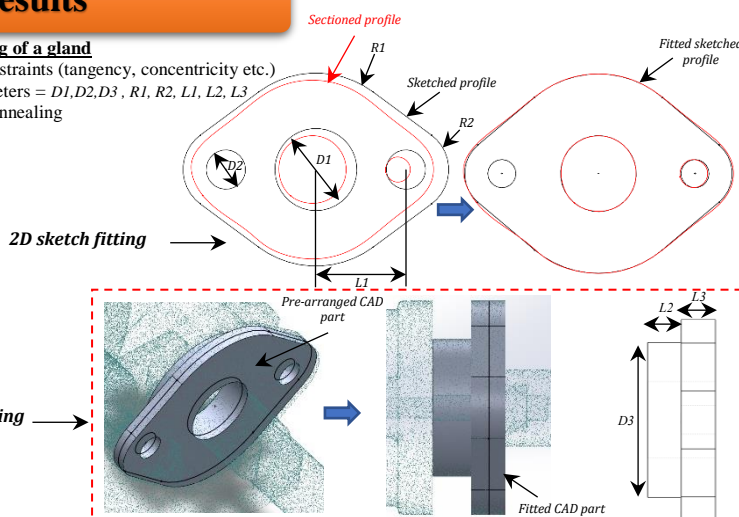
4 Methodology

5 Results

Local fitting of a gland
Internal constraints (tangency, concentricity etc.)
Free Parameters = *D1,D2,D3 , R1, R2, L1, L2, L3*
Simulated annealing

Groups	Parameters	Initial value (mm)	Required value (mm)	Obtained value (mm)	Absolute deviation (mm)	Relative deviation
2D sketch	D1	23	19	19.061	0.061	0.0032
	D2	11	7	7.060	0.060	0.0086
	R1	10	10	9.367	0.633	0.0633
	R2	27	25	24.990	0.990	0.0396
	L1	24	24	24.315	0.315	0.0131
3D part	D3	30	32	32.036	0.036	0.0011
	L2	7	32	31.921	0.079	0.0025
	L3	4	8	7.992	0.008	0.0010

Table.1: Evolution of the relative deviation

Conclusions
- Different modules can be combined for fitting.
- Proposed solution can be used for global and local fitting.
- Faster as compared to previous patch-by-patch strategy.
- Several parts can be fitted simultaneously.
- Fitting of sketch/part/assembly assemblies.
- Bypasses data manipulation.