

Assembly retrieval results inspection in immersive environment

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The research objective is the definition and the set-up of an immersive environment where the users can easily browse the results of CAD assembly retrieval systems, naturally interact and analyze complex assembly models and their constituting components, modify them and eventually compose new models.

The retrieval system

Given an assembly CAD model, our content-based retrieval system returns similar models according to several criteria. Focusing on complex CAD assemblies, it is tricky communicating in an effective manner the results. To highlight and inspect the detected similarities a VR environment has been developed.

Communication



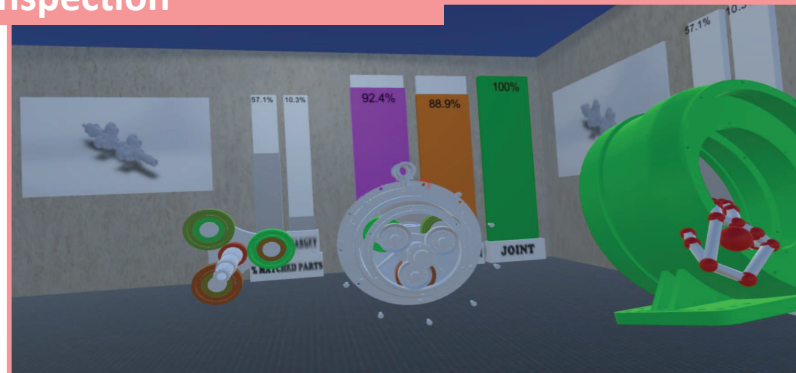
The communication of the results is performed by a spatial metaphor according to which the assembly models are arranged in the 3D space such that models closer to the query model are more similar than farther models. Hence, each assembly is located in a specific point of the 3D space according to the values of three similarity measure $\vec{\mu} = (\mu_{shape}, \mu_{joint}, \mu_{position})$ [LGMP18]. In this way, the Cartesian coordinates x , y and z reflect respectively the three measures of similarity (shape, position and joint).

Several elements furnish the space. On the floor three arrows show the directions along which the measures decrease. On the walls an image of the query model is projected together with three colored columns displaying the exact values of the three similarity measures. In addition, on the wall two gray-colored columns show the percentage of the matched elements over the number of parts in the query and the compared model respectively.

Future works

The current development allows the analysis and the manipulation of complex assembly models in an immersive environment where users easily interact with models and their components. Future research will focus on the modification of the CAD model as well as the composition of new models performed directly in the VR environment.

Inspection



Object selection

Object selection is performed in two steps: **target acquisition** and **selection confirmation**.

In the proposed VR system it is possible to select entire assembly models or their single parts. In both cases, for the acquisition, the user is guided by the change of the color of the object hit by his/her gaze. Then, either the voice command *select* or the gesture *tap* performed with the index finger confirm the selection.

Voice commands

Voice commands help users providing several shortcuts

- Select to confirm gaze selection
- Undo to cancel the last performed transformation
- Restore to reassemble the selected (all) disassembled (restore all) model(s)
- Show matching to highlight the matched parts between query and selected models while putting in transparency the not matched parts
- Show assemblies to undo the "show matching parts" command
- Return to go back to the previous scene.

Gestures

It is possible to manipulate the virtual models with hands movements

