FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

Structure-Aware Manipulation of Geometric 3D Models

Masterstudium:
Visual Computing

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Problem Statement

Adapting existing 3D models from the internet can be a challenging task for inexperienced users. Due to the wide availability of tablets and other modern hardware, these users are becoming the main focus group of such applications. Structure-aware model manipulation helps these users by preserving the overall structure when editing. Until now, changes in the number of repetitions can only happen along straight lines and on grids. We show a framework, which supports a wider variety of model adaptations by using symmetries along curves.

Contributions

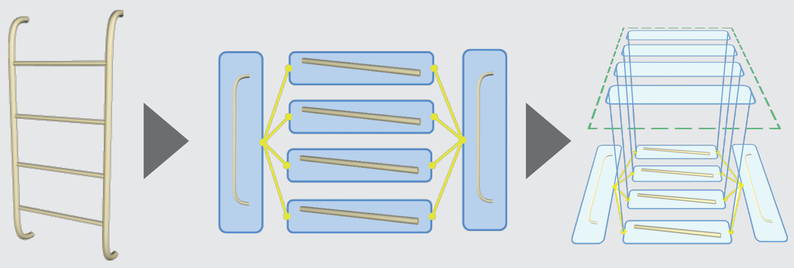
This work contributes in several stages of structure-aware model manipulation systems:

- **Extension of the Part-Relation model** by using a layered graph to cover symmetry groups better
- A novel technique for **binary relation detection**
- A **new formulation for symmetries** in terms of arrangements on parametric curves

Model Analysis

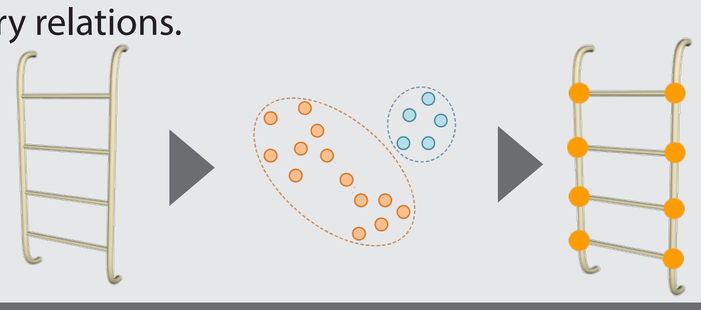
Part-Relation Model

Parts and their connections are transformed to a connectivitiy graph. Symmetry groups are described by additional layers.



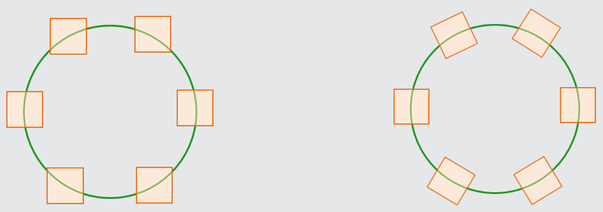
Binary Relation Detection

Binary relations connect parts. Clustering mesh intersections yields only a few, but important binary relations.



Symmetry on Curves

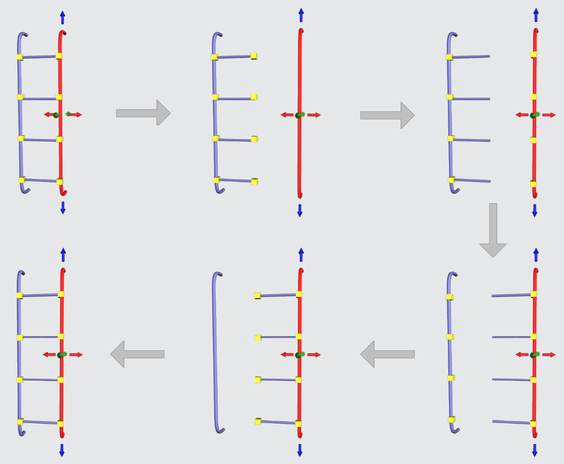
Curve symmetry describes arrangement of parts along curves. Parts can be restricted to translations or oriented in the Frenet frame.



Model Modification

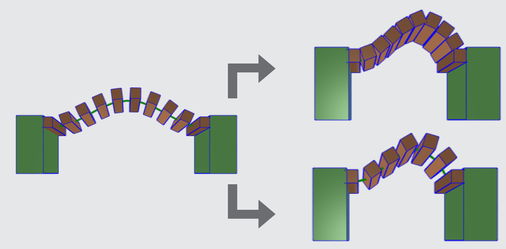
Propagation

All changes made by the user are propagated through the connectivity graph in a breadth-first manner. Parts and binary relations are modified only once to avoid loops.

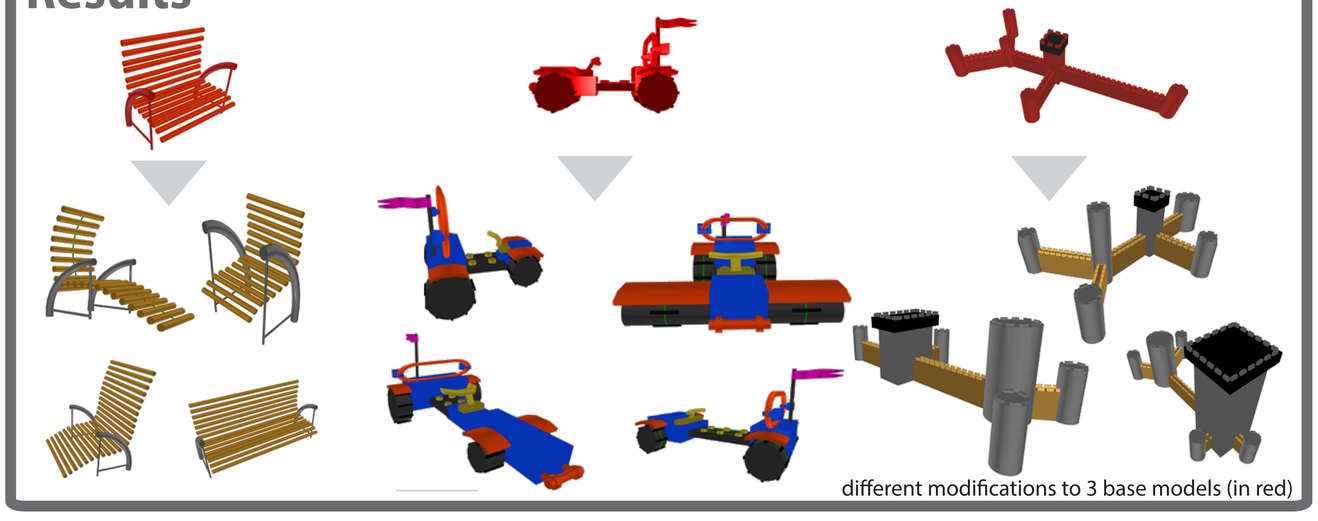


Symmetry Update

Curve-symmetric parts are reorganized to follow the curve. They can be rearranged, or the number of repetitions can be adapted.



Results

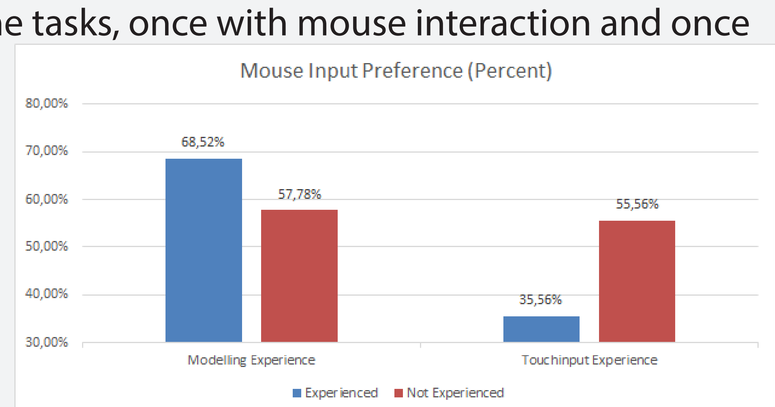


different modifications to 3 base models (in red)

User Study and Conclusions

We performed a user study to prove that our system can be handled by inexperienced users. We also evaluated which input method the users prefer for our system: touch interaction or mouse interaction. Every user had to perform nine tasks, once with mouse interaction and once with touch interaction.

All participants were able to solve the tasks with both interaction methods, which proves that our system can be handled by our target group.
Touch interaction is best accepted by users without modelling knowledge and with touch input experience, although there is big room for improvements.
Due to our questionnaire, we found that the system is very well accepted by the users and that the system behaves as expected.



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