Human Computer Interaction
Prof. Dr. Patrick Baudisch
Masterprojekt Sommersemester 2021

Algorithmic Folding

In this project, you will write algorithms that *unfold* 3D models into optimal 2D cutting plans, such as the chair shown below. This matters, because foldable composite materials, such as the paper-foam-paper composite “foamcore” (below center), have the potential to eliminate many of the hurdles historically faced by laser cut 3D models, in particular the necessity to hunt and peck for plates during assembly—the slowest step in the fabrication process. Algorithmically unfolded composite materials provide the produced model is a single strip, thereby making models trivial to assemble. This holds tremendous potential for speeding up the assembly of laser cut models—and with it, making rapid prototyping itself faster.

(a) This Laser cut chair takes 24min to assemble. (b) The same chair folded from a three-layer composite material assembles 10x faster. (c) The unfolding your algorithm will have to produce.

In this project, you will tackle a range of novel challenges inherent to unfoldable composite materials, such as how to handle integrated structures, such as flexible elements, hinges, how to make sure scrap material can be removed, and how to unfold models at interactive rates while the user is manipulating the 3D model, by unfolding models progressively.

Technologies involved in this project

Based on this, the objective of your master project will be: (1) create algorithms and software tools to enable the functionalities described above, (2) demonstrate their validity by processing a range of test models. (3) Integrate your code into an existing 3D interactive environment.

1. You will write in JavaScript/Typescript
2. You will write code that manipulated 3D models
3. You will write graph algorithms that deal with np-problems
4. You will integrate your code into a medium-size software system (120.000 lines of code, kyub.com)

Contact

Email me at muhammad.abdullah@hpi.de or email me to schedule a meeting at my office on the 2nd floor of the main building (H-2.33).