m.sc. architecture thesis by dominik reisach

upcycle timber

a design-to-fabrication workflow for free-form timber structures with offcuts

this thesis was supervised by
prof. dr.-ing. sven schneider (a+u)
prof. dr. jan willmann (k+g)
prof. dr.-ing. stephan schütz (a+u)

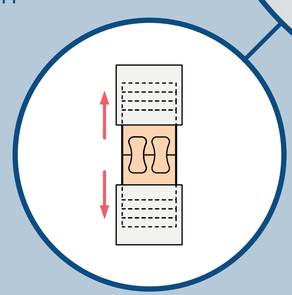
offcut waste

digital twin

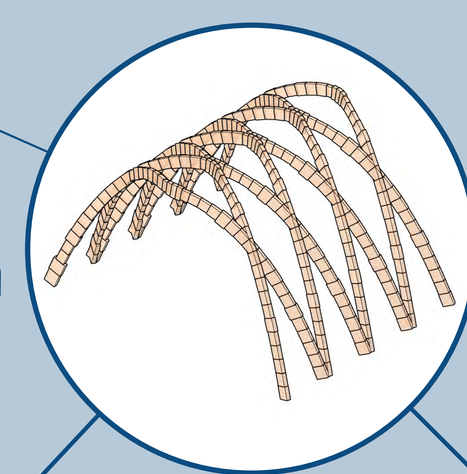
```
public class Offcut
{
    public Brep OffcutGeometry { get; set; }
    public double Index { get; set; }
    public double X { get; set; }
    public double Y { get; set; }
    public double Z { get; set; }
    public double Vol { get; set; }
    public Plane FirstPlane { get; set; }
    public Plane SecondPlane { get; set; }
    public int PositionIndex { get; set; }
    ...
}
```

offcuts

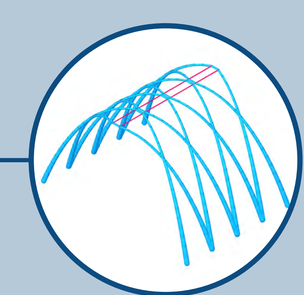
material tests



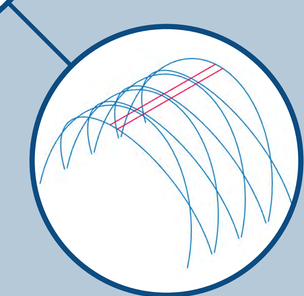
design

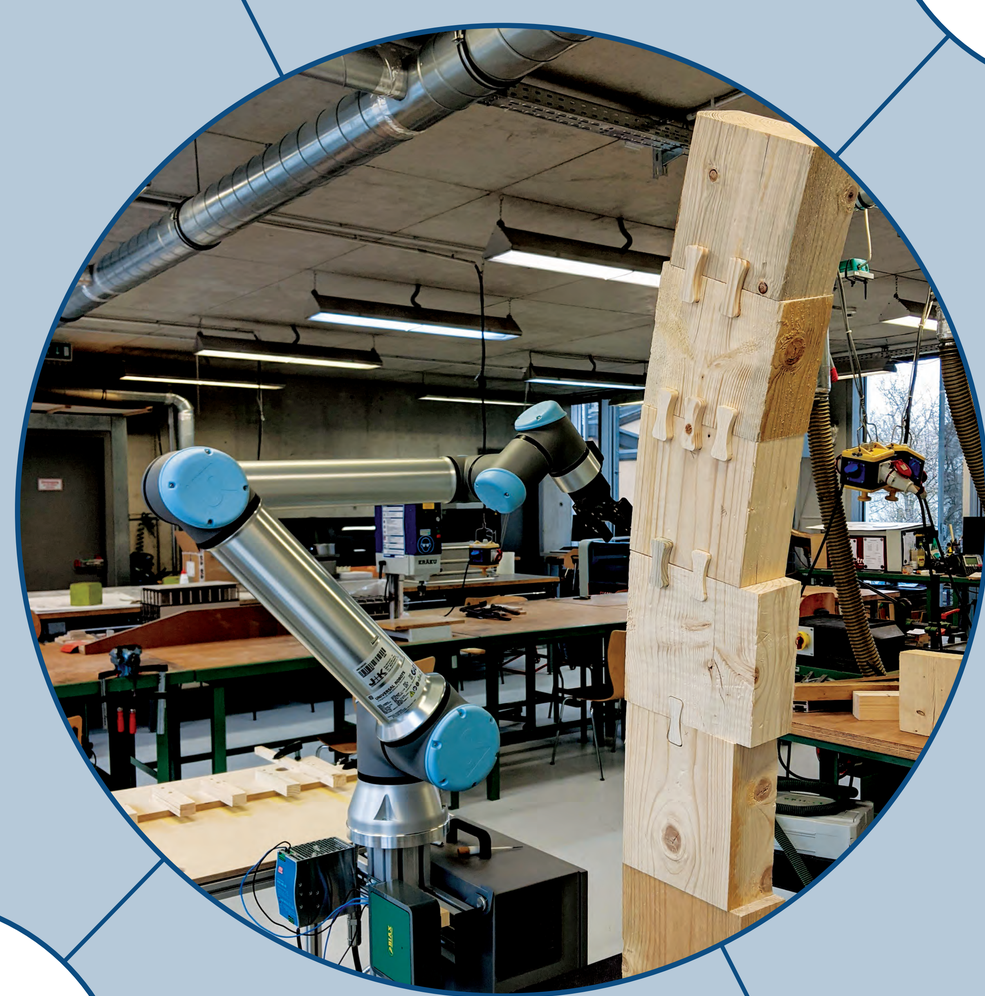


optimization

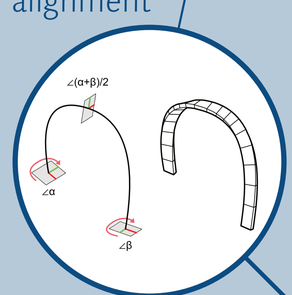


design curves

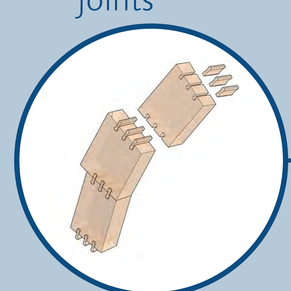




alignment



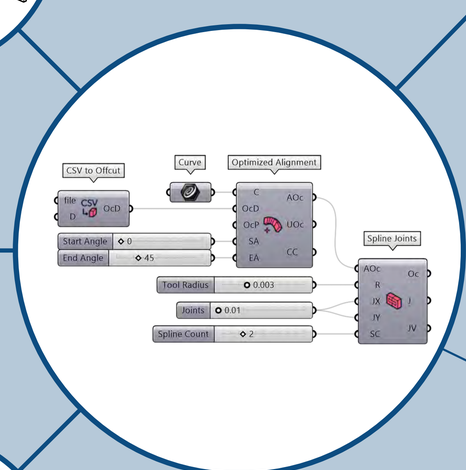
joints



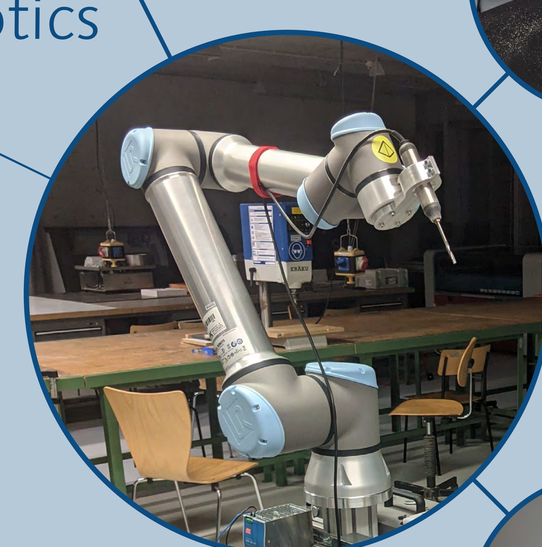
algorithm

github

code



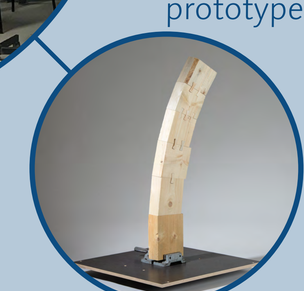
robotics



milling

assembly

prototype



assembly

upcycle waste?

The **climate crisis** demands that we rethink the ways we deal with material waste. Therefore, this work explores methods for upcycling and designing **low-engineered** free-form structures with offcuts—a **waste material** from local timber production. In particular, the focus is on the development of a complete **design-to-fabrication** workflow that closes the digital chain. The process is streamlined to **minimize material waste** and facilitate the **dis- and reassembly** of offcut structures. For this purpose, this research developed appropriate tools for an architectural design process to align offcuts, compute wood joints, and generate fabrication-relevant data. The feasibility of this work is demonstrated through the design, **robotic fabrication**, and **collaborative assembly** of a **1:1 prototype**.

All illustrations, photographs, and images by Dominik Reisach, 2022.

Bauhaus-Universität Weimar