# Rapid Prototyping

## A Process for the Manufacturing of Custom Maypole Braiding Machines

### Motivation: Tissue Engineering

The regeneration of load-bearing tissues, such as ligaments, bone, and cartilage, requires temporary scaffolds that provide mechanical stability while supporting cell attachment, proliferation, and tissue formation.

Scaffold architecture is a key factor influencing cellular behaviour, nutrient transport, and tissue development. Among the various scaffold designs, braided structures have gained increasing attention due to their combination of advantageous properties

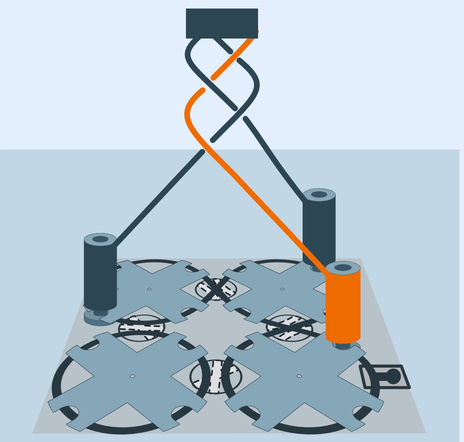
- Flexibility
- High tensile strength
- Shear resistance
- Controllable porosity
- Efficient energy absorption

### Challenge

The development of novel braiding machines is challenged by uncertainties in predicting the braiding process during the design phase. In particular, the precise location of the fell point and the resulting braid geometry are difficult to determine a priori, complicating the optimization of yarn guidance systems and carrier trajectories for process stability. Additive manufacturing addresses these challenges by enabling:

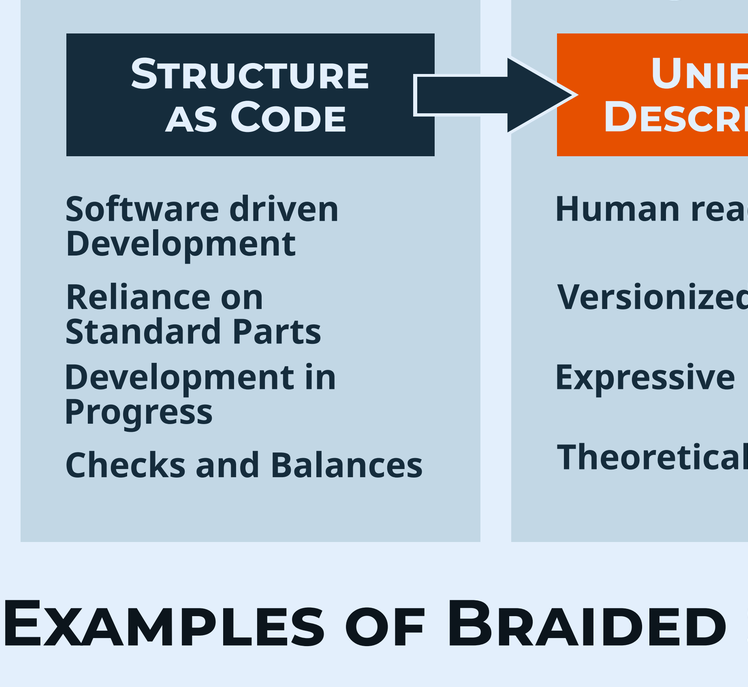
- **Rapid design validation** through fast, cost-effective production of functional prototypes.
- **Short iterative development cycles** for testing and optimising machine concepts.
- **Reduced development costs and risk**

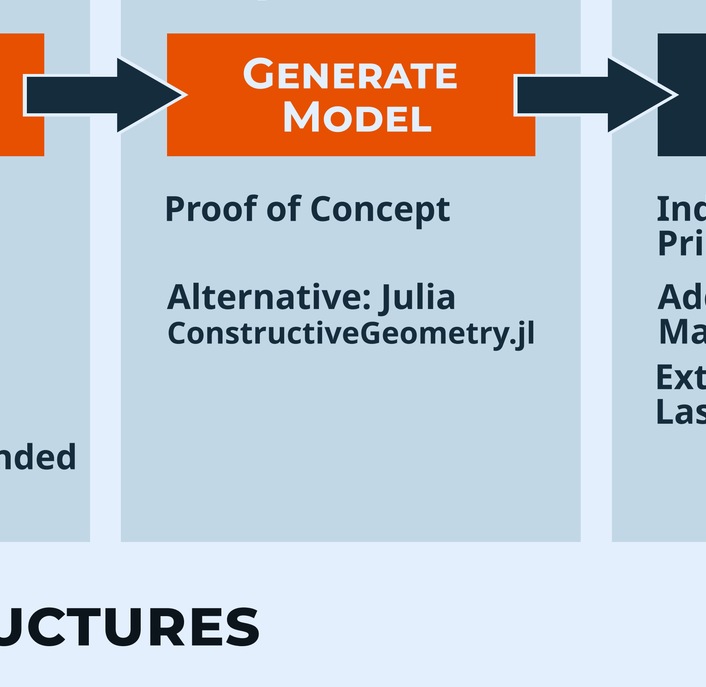
## Methodology: From Description to Prototype

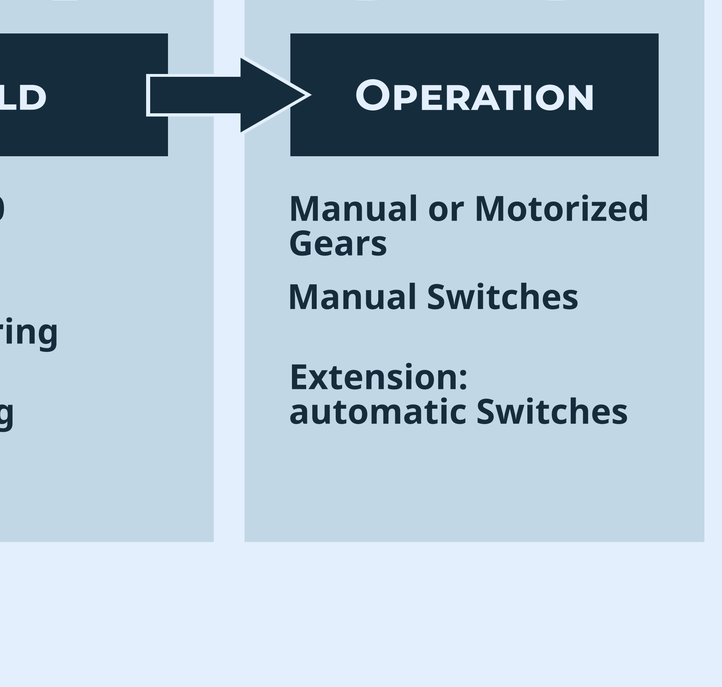


| Structure as Code | Unified Description | Generate Model | Build | Operation |
|---|---|---|---|---|
| Software driven Development | Human readable | Proof of Concept | Industry 4.0 Principles | Manual or Motorized Gears |
| Reliance on Standard Parts | Versionized | Alternative: Julia ConstructiveGeometry.jl | Additive Manufacturing | Manual Switches |
| Development in Progress | Expressive | | Extension: Lasercutting | Extension: automatic Switches |
| Checks and Balances | Theoretically grounded | | | |

## Examples of Braided Structures





CARL VON OSSIETZKY UNIVERSITÄT OLDENBURG
OFFIS
ZUKUNFTS ZENTRUM NORD
Bundesministerium für Arbeit und Soziales
Co-funded by the European Union


BRAIDING.ROCKS
https://braiding.rocks