Structural Reuse by Design

Reusing wind turbine blades for building applications

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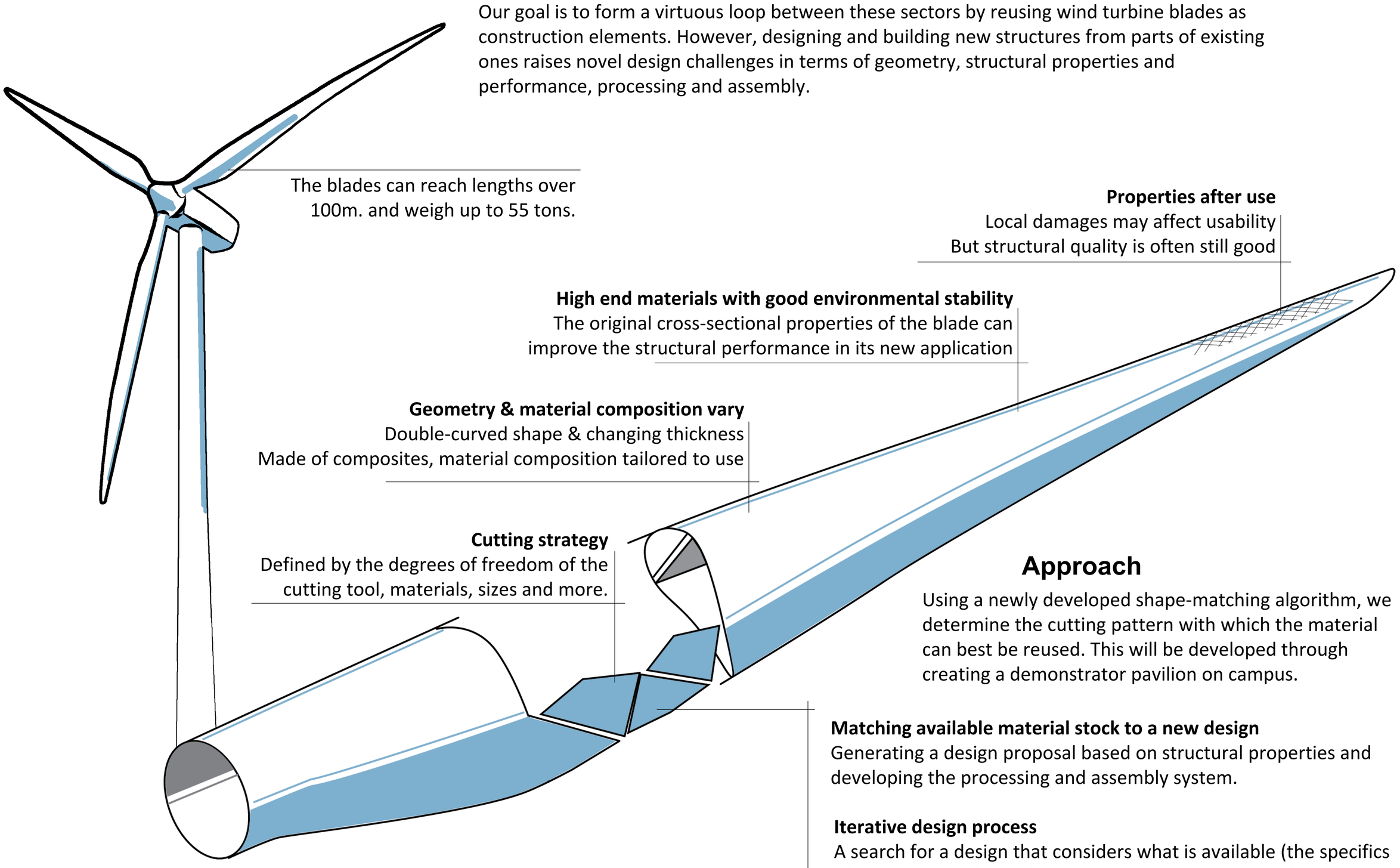
Structural Reuse by Design
Reusing wind turbine blades for building applications

Challenge

Construction industry needs large volumes of materials and has a large carbon footprint. And although wind energy is renewable, the blades are hard to recycle leading to material waste. Our goal is to form a virtuous loop between these sectors by reusing wind turbine blades as construction elements. However, designing and building new structures from parts of existing ones raises novel design challenges in terms of geometry, structural properties and performance, processing and assembly.



Approach

Using a newly developed shape-matching algorithm, we determine the cutting pattern with which the material can best be reused. This will be developed through creating a demonstrator pavilion on campus.

Matching available material stock to a new design
Generating a design proposal based on structural properties and developing the processing and assembly system.

Iterative design process
A search for a design that considers what is available (the specifics of the actual blade) and what you wish to build (a pavilion).

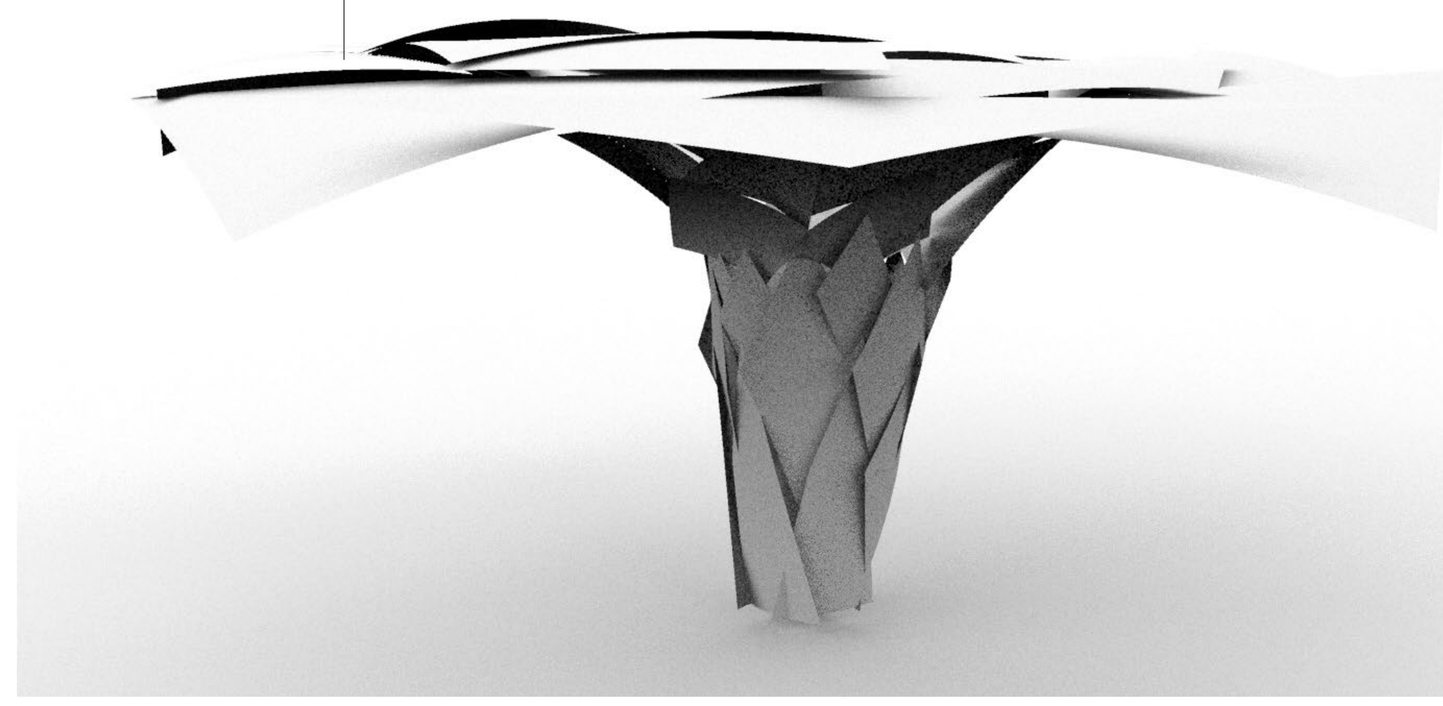
Assembly system
Connections need to cope with varying thickness and curvature
The structure will be self-supporting, leveraging material quality.

Findings

Defining the design space
The curvature of the blade largely restricts design possibilities: panels cannot intersect, but the predetermined curves make this difficult to avoid.

Finding applications
The material characteristics need to be determined to define valuable reuse applications. Next to geometry & mechanical characteristics, we investigate its acoustic performance.

Data and material availability
Design specifications are often guarded by IP but needed for reuse. A Digital Product Passport could bundle information and provide an opportunity for a systematic and standardized data collection system throughout the supply chain of the wind industry.



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