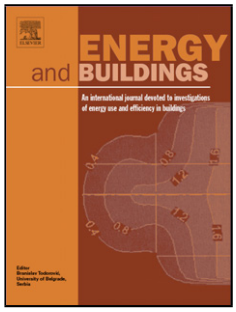

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An autonomous shading system based on coupled wood bilayer elements

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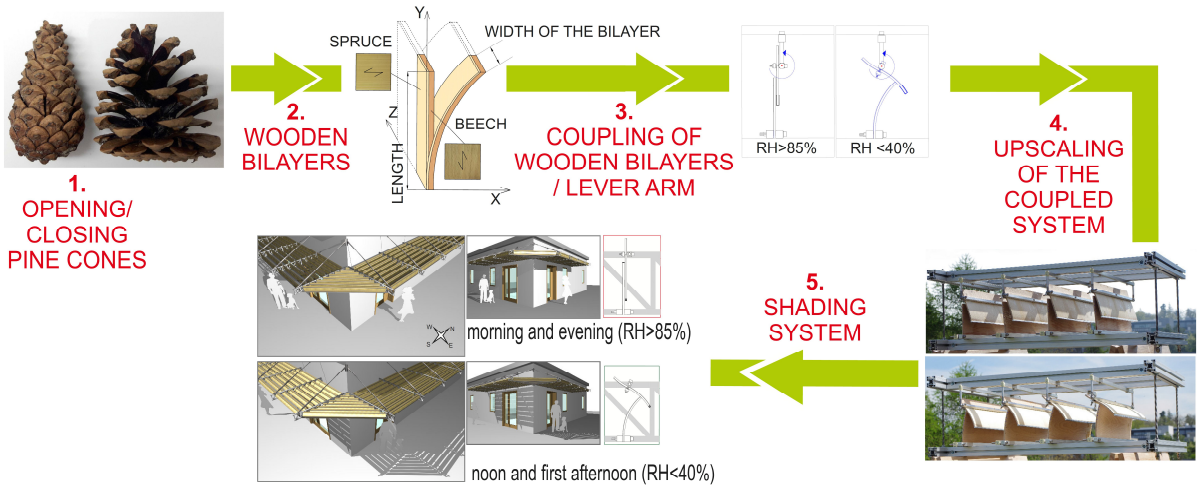
Key words

Wood; *hygroscopicity*; swelling and shrinkage; wood bilayers; coupling of elements; autonomous movement, repeatable and reversible actuation; shading system; CABS-building envelope

Graphical abstract



Abstract

Climate Adaptive Building Shells can help to reach the aimed and required global reduction of energy consumption in the building sector. By being implemented as, e.g., façade shading systems, their adaptability to environmental changes can improve energy efficiency and indoor comfort of buildings. Autonomous, humidity-driven wood bilayers are proposed as an alternative to motor-driven façade shading elements. Due the hydro-responsiveness of the wood material, the changes of relative humidity during day and night as well as the drying effect of direct solar radiation can be utilized for inducing cyclic programmed shape changes of wood bilayers for aperture opening and closing of such adaptive façade shading systems. The kinetics of such autonomous shape changes of wood bilayers have been analyzed at small scale, but the application-relevant upscaling remains a challenge. So far, the proposed solutions do not allow simultaneously for a sufficient rate of shape change and the required mechanical stability of the wood bilayers. Here, we present the coupling of two wood bilayers as one possible