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Abstract Submitting Form

Conference	<u><a href="#">11<sup>th</sup> Annual International Conference on Industrial, Systems and Design Engineering</a></u> <u><a href="#">19-23 June 2023, Athens, Greece</a></u>		
Title of Paper	<b>Bamboo as a lightweight material in mobile applications using the example of a city bike</b>		
For more than one author, please copy and paste the following eight rows for each additional author.			
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<u>Abstract</u>			
<b>Please try to limit your abstract to less than 500 words (about 30 lines)</b>			
<p>Bamboo is an environmentally friendly alternative to conventional materials in mechanical engineering such as steel or aluminium. Bamboo is the fastest growing plant in the world. Instead of releasing CO<sub>2</sub> during the manufacturing process, bamboo absorbs CO<sub>2</sub> as it grows.</p> <p>In addition to the sustainability aspect, bamboo tubes also offer excellent properties as a lightweight construction material, which have been optimised through evolution. Bamboo tubes have high strength and stiffness at low weight when used as tension-compression bars or bending beams. Bamboo has strong, high-density fibres at the boundary area, where bending stresses are greatest. Towards the inside, where the stresses are lower, the bamboo becomes porous to optimise weight. This, together with knots arranged in regular intervals, counteracts buckling.</p> <p>In mobile applications such as cars and bicycles, lightweight construction is sought for energy efficiency reasons. Because of its excellent lightweight properties, the project investigated whether bamboo could be used in mobile, automotive or agricultural engineering. For example, a bamboo bicycle frame has been developed with the aim to be as light as possible. There are bamboo bicycles on the market, but they can only be made one at a time by hand. The bamboo tubes are joined together and functional elements such as the bottom bracket and headset are integrated by wrapping them in resin-impregnated natural or carbon fibres. This makes the joints very heavy. A different approach is taken here: the bamboo tubes are drilled out slightly to achieve a defined internal diameter, and then short aluminium tubes are glued into the bamboo canes from the inside. To prevent the cane from breaking in the circumferential direction, i.e. perpendicular to the fibre direction, the bamboo tubes are wrapped in a thin layer of natural or carbon fibre impregnated with synthetic resin. The aluminium tubes and functional elements are welded or soldered together beforehand.</p>			

The design of the bicycle frame, i.e. the dimensioning of the bamboo tubes and joints, was based on extensive bending and tensile tests to determine the strength properties of the natural material bamboo. The bonding between the bamboo cane and the aluminium tube was also investigated experimentally. Finally, several prototype bicycle frames were made and tested for durability according to DIN-EN-14764. The frames passed the tests.

The result is a bamboo bicycle that is manufactured with standardised connectors and joints. The assembly concept developed allows both fully automated and semi-automated series production of bamboo bicycles.

**Keywords (at  
least three)**

Leightweight construction, bamboo, bicycle

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