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NUMERICAL MODELLING AND EXPERIMENTATION OF HISTORICAL CARPENTRY CORNER LOG JOINTS

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Corner joints constitute an important part of the building's structural system, ensuring proper transmission of forces from external loads, as well as ensuring spatial rigidity of the building. Even if often used in buildings in past centuries, it is difficult to find studies on carpentry corner joints of solid walls in log buildings [1]. On the other hand, that knowledge is very important because of the need to preserve, renovate and strengthen existing elements in many historic timber constructions [2]. Therefore, the main goal of the study is to analyse the mechanical behaviour of traditional corner joints made of logs and to find the stress distribution in a loaded wall. This will allow us to choose the most fault-tolerant connection type and determine the distribution of stress on the contact surfaces which is the damage area.
Two types of traditional carpentry corner log joints: the short-corner dovetail connection and the cross connection are modelled and analysed by means of finite element method. The wood is considered here as an orthotropic material. Since the numerical analysis of timber structures is not a trivial issue as reported in literature due to the complexity of the material and its mechanical performance, the experimental study on the joints has also been undertaken to observe the structural damage process and to validate the numerical outcomes. The results show the main difference in behaviour of both types of joints that provides a good basis for the correct planning a reliable rehabilitation of historic buildings.

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REFERENCES

[1] A. Klein and M. Grabner. Analysis of Construction Timber in Rural Austria: Wooden Log Walls. *Int. J. Archit. Herit.*, Vol. **9**, pp. 553–563, 2015.
[2] T. P. Nowak, J. Jasieńko, and D. Czepizak. Experimental tests and numerical analysis of historic bent timber elements reinforced with CFRP strips. *Constr. Build. Mater.*, Vol. **40**, pp. 197–206, 2013.