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PII: S0266-3538(16)30889-2

DOI: [10.1016/j.compscitech.2016.10.015](https://doi.org/10.1016/j.compscitech.2016.10.015)

Reference: CSTE 6546

To appear in: *Composites Science and Technology*

Received Date: 4 August 2016

Revised Date: 10 October 2016

Accepted Date: 19 October 2016

Please cite this article as: Vorobyev A, Bjurhager I, van Dijk NP, Gamstedt EK, Effects of barrelling during axial compressive tests of cubic samples with isotropic, transversely isotropic and orthotropic elastic properties, *Composites Science and Technology* (2016), doi: 10.1016/j.compscitech.2016.10.015.

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# Effects of barrelling during axial compressive tests of cubic samples with isotropic, transversely isotropic and orthotropic elastic properties

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## Abstract

For scarce materials, such as archaeological wood, cubic samples are often used instead of standardised prisms for mechanical tests, since the elasticity can be determined in all three directions within a single sample, but with such samples barrelling makes it difficult to identify the elastic properties. The purpose of the present study is firstly to numerically investigate the effects of barrelling in cubic samples during compressive testing; secondly to numerically investigate and compare barrelling on isotropic and transversely isotropic material parameters; thirdly to compare four strain measurement techniques using digital image correlation, strain gauges and direct readings from the testing machine and finally to estimate the error due to barrelling by implementing the experimentally obtained orthotropic material parameters to the numerical model. The presented relative errors provide information when the perturbation caused by barrelling is negligible or significant for various materials and strain measurements. As an example, the results of compressive tests on waterlogged archaeological oak impregnated with polyethylene glycol are discussed.

*Keywords:* Cubic samples, Compressive testing, Barrelling formation, Wood

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