The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

HOMOGENIZATION OF THE CONSTITUTIVE PROPERTIES OF COMPOSITE BEAM CROSS-SECTIONS

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Keywords: *Composite materials, Homogenization, Effective constitutive properties, Cosserat rod*

When modelling beam-like objects made of composite materials using a beam theory, homogenized stiffness coefficients must be obtained. In [1, 2], analytic expressions for these are obtained by comparing the solutions of some extension, bending and torsion problems for the directed curves with the corresponding results obtained for three-dimensional rods. In [1], the authors provide general expressions for the determination of these coefficients for multilayered beams.
This work consists in the study of a homogenization procedure of the stiffness coefficients for hollow circular cross-sections with several layers. This will help in the study of the constitutive behavior of unloaded shafts of endoscopes. An experimental campaign was carried out at KARL STORZ GmbH & Co. KG (Tallinn, Estonia) in order to evaluate the stiffness coefficients concerning the bending and torsion of such devices. Experimental results will be compared to the numerical ones obtained from nonlinear Cosserad beam model simulations.

Acknowledgments: This project has received funding from the European Union's Horizon 2020 research and innovation under the Marie Skłodowska-Curie grant agreement No.860124.

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