Finite bending of beams with anticlastic effect: analytical model, experimental test and FE modeling

Federico.O Falope[1], Luca Lanzoni[1], Angelo Marcello Tarantino[1]

[1] *University of Modena and Reggio Emilia, Department of Engineering Enzo Ferrari, DIEF, Via P. Vivarelli 10, 41125, Modena, Italy*
E-mail:federicooyedeji.falope@unimore.it

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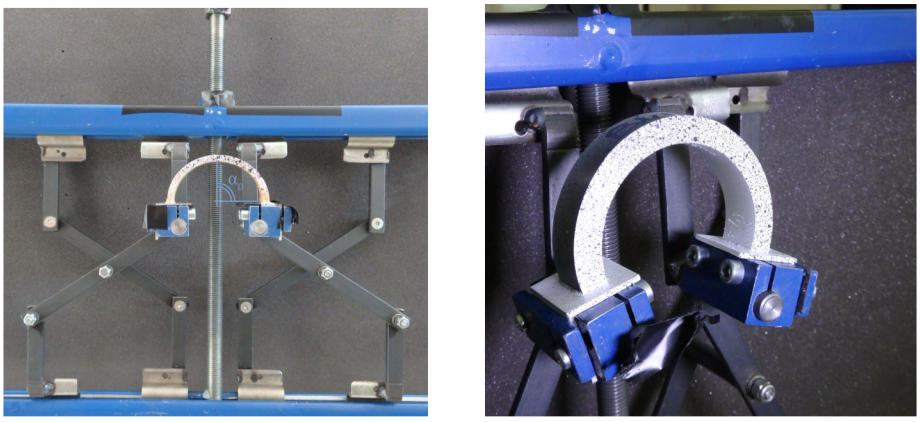
A recent model of a bent solid in finite elasticity appears in Literature [1]. Making reference to a compressible Mooney-Rivlin material, such a model is able to describe properly the anticlastic effect arising in a bent beam made of a rubber-like material.

An experimental device is here presented (see Figure 1) aimed at simulating pure bending. In particular, the device lets the specimen free to exhibit its own elastic retaining force. Accordingly, the bent sample assumes the shape of an arc of circumference. With the aid of a DIC optical monitoring system, the experimental displacement field is acquired during the deformation process varying the angles α_0 imposed at the final beam cross sections.



(a) (b)

Figure 1: Experimental pure bending device.

For different rubber specimens, based on a theoretical model [2], both compression and tensile tests have been performed in order to properly characterize the constitutive parameters. Once the constitutive parameters have been found, by means of non-linear fitting experimental data, a FE model has been carried out in order to reproduce the experimental test. A good agreement is found among analytical, experimental and numerical results, thus showing the reliability of the proposed experimental device together with the consistency of the basic hypotheses of the theoretical model.

References

[1] *Lanzoni, L., Tarantino, A. M., "Finite anticlastic bending of hyperelastic solids and beams", Journal of Elasticity,* **131**, *137-170 (2018).*

[2] *Lanzoni, L., Tarantino, A.M., "Equilibrium configurations and stability of a damaged body under uniaxial traction", ZAMP,* **66** *, 171-190 (2015).*