Modeling of inelastic effects in composite cables by means of Hysteresis operators

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The present contribution aims at describing hysteresis behaviour arising from cyclic bending experiments on cables by means of the Preisach operator. As shown in pure bending experiments, slender structures such as electric cables behave inelastically and open hysteresis loops arise, with noticeable difference between the first load cycle and the following ones.
The Preisach operator plays an important role in describing the input-output relation in hysteresis behaviours and it can be expressed as a superposition of relay operators $\mathcal{R}_{s-r,s+r}[v](t)$

$$w(t) = \mathcal{P}[v](t) = \int_0^{+\infty} \int_{-\infty}^{+\infty} \omega(r,s)\mathcal{R}_{s-r,s+r}[v](t)dsdr.$$

The definition of the Preisach plane occurs naturally from the definition of Preisach operator and hysteresis loops can be computed by integrating a suitable kernel function $\omega(r,s)$ over a domain included in the Preisach plane, described by the variables r and s.
A mathematical formulation of the problem is introduced and a first attempt is made to mathematically determine the hysteresis behaviour that describes the relation between curvature (i.e. input $v(t)$) and bending moment (i.e output $w(t)$) of specific electric cables. Therefore, a suitable kernel function is identified in a way that its integration over the Preisach plane results in the bending moment of the specimen.