Characterization and computational modeling of electrical wires and wire bundles subject to bending loads

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Highlights

- Synergistic computational-experimental approach is presented to characterize the mechanical behavior of electrical wires and taped wire bundles in bending.
- Elucidate the significant role of plasticity on the deformed shape of wires subject to bending moments, as well as the uncertainty caused by residual stresses.
- A customized cantilever bending test is developed to characterize material properties and calibrate/validate finite element (FE) models of single wires and taped wire bundles.
- A high-fidelity 3D FE model is developed to simulate the deformed shapes of taped wire bundles considering material/geometrical nonlinearity and contact-friction between wires.
- The study shows that 1D FE models relying on homogenized elastoplastic properties, evaluated using an optimization algorithm, can accurately predict the deformation response of single wires and taped wire bundles in bending.