Mechanical characterization of an electrostrictive polymer for actuation and energy harvesting

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Résumé en anglais	Electroactive polymers have been widely used as smart material for actuators in recent years. Electromechanical applications are currently focused on energy harvesting and actuation, including the development of wireless portable electronic equipment autonomous and specific actuators such as artificial muscles. The problem to be solved is to make its devices the most efficient, as possible in terms of harvested energy and action. These two criteria are controlled by the permittivity of the electrostrictive polymer used, the Young's modulus, and their dependence on frequency and level of stress. In the present paper, we presented a model describing the mechanical behaviour of electrostrictive polymers with taking into account the mechanical losses. Young's modulus follows a linear function of strain and stress. However, when the elongation becomes higher, the data obtained from this strain linear trend and significant hysteresis loops appear the reflections on the existence of mechanical losses. In this work, to provide the analysis of the experimental observations, we utilized a theoretical model in order to define a constitutive law implying a representative relationship between stress and strain. After detailing this theoretical model, the simulation results are compared with experimental ones. The results show that hysteresis loss increases with the increase of frequency and strain amplitude. The model used here is in good agreement with the experimental results.
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