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Effects of surface and interface energies on the bending behavior of nanoscale multilayered beams

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With the development of power system and wide use of power electronics, power quality becomes poor and poor, which increasingly attracts the attention of people. In order to improve power quality, the efficient and accurate disturbance detection and classification from massive power quality data is necessary for us to realize power quality analysis and control. This paper proposed a real time power quality disturbances classification by using a hybrid method based on S transform and dynamics. Classification accuracy and runtime are mainly concerned. A modified continuum model of the nanoscale multilayered beams is established by incorporating surface and interface energies. Through the principle of minimum potential energy, the governing equations and boundary conditions are obtained. The closed-form solutions are presented and the overall Young's modulus of the beam is studied. The surface and interface energies are found to have a major influence on the bending behavior and the overall Young's modulus of the beam. The effect of surface and interface energies on the overall Young's modulus depends on the boundary condition of the beam, the values of the surface/interface elasticity constants and the initial surface/interface energy of the system. The results can be used to guide the determinations of the surface/interface elasticity properties and the initial surface/interface energies of the nanoscale multilayered materials through nanoscale beam bending experiments.

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