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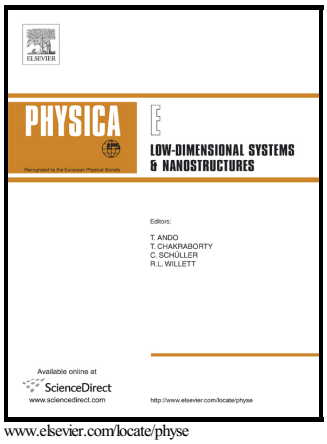

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Some Modifications in Evaluation of the Size Effects Related to Surface Stresses in Nanostructures

Abbas Assadi [*], Mehdi Akhlaghi [**], Manouchehr Salehi [+]

[*] PhD Student of Mechanical Engineering, *Email*: assadi@aut.ac.ir, Tel: +989128239049.

[**] Professor of Mechanical Engineering, *Email*: makhlagi@aut.ac.ir, *Tel*: +9821664543419.

[+] *Corresponding Author*: Associate Professor of Mechanical Engineering,
Email: msalehi@aut.ac.ir, *Tel*: +989124988984 , *Fax*: +982166419736.

Mechanical Engineering Department, Amirkabir University of Technology (AUT), Tehran 15914, Iran

ABSTRACT

In this work, addressing some contradictions, it is tried to interpret some gaps between surface stress theories and the size effects observed in experiments for nanowires through different examples. Due to mandatory self-equilibrium state of nanostructures at different states, in a generalized model, a balancing factor is defined for the surface residual stress and duly the clamped nanowires are classified into suspended and etched types. The claims are confirmed by observing similar results for bending and tensile tests of Ag nanowires that addresses alternative sources for size effects beside the surface stresses. In addition, the size effects and surface material properties are identified lower at larger deformation ranges and regarding tremendous gap between atomistic simulation and continuum core-shell models, it is verified that the surface elasticity may not be the entire source for size effects. In extension, due to anisotropicity of single crystals, two orientation dependent parameters are defined for nanoplates that are modeled based on Kirchhoff plate, von-Karman strains and surface stress models. It is shown that orientation of (100)-nanoplates changes the size effects for more than 70%. Meanwhile, some test setups are recommended for characterization of the size effects of nanowires and nanoplates.

KEYWORDS

- *Nanowires and nanoplates*
- *Surface stress models*
- *Gaps between theory and experiments*
- *Balancing self-equilibrium factor*
- *Nonlinear deformation occurrence*
- *Anisotropicity of nanoplate*