# ABSTRACT

This paper presents the effects of surface stress and nonlocal elasticity on the free vibration of nanobeams with various boundary conditions. The analytical solutions for natural frequencies and corresponding mode shapes of nanobeams are derived and compared numerically by using the finite element method. The identical results between two solution methods are obtained. The obtained results indicate that the surface stress and nonlocal elasticity affects directly on the free vibration behavior of nanobeams. The effect of surface stress is to increase the stiffness of nanobeams. Therefore, the natural frequencies of nanobeams for all boundary conditions are increased in comparison with the classical Euler beam. Moreover, the surface stress affects significantly only for the lower modes of vibration. In case of nonlocal elasticity effect, it reduces the natural frequencies of nanobeams, especially for the higher modes of vibration. For nanobeams including both effects, the results show that the natural frequencies are in between one of the nanobeams with surface stress and the one with nonlocal elasticity. This gives a practical implication that not only the surface stress but also nonlocal elasticity affects directly on the vibration behavior of the nanobeams. However, the surface stress affect only the lower modes of vibration and therefore the results of nanobeams including both effects are converted to the nanobeams where only nonlocal elasticity is considered for the mode number with higher than fourth mode. In case of vibration mode shapes, the surface stress and nonlocal elasticity affect for all boundary conditions except pinned-pinned and sliding-pinned nanobeams.

Keywords : Nanobeams / Surface Stress / Nonlocal Elasticity / Analytical Solution / Finite Element Method.