

Application of the Extended Kantorovich Method to Size-Dependent Vibrational Analysis of Fully Clamped Rectangular Micro-Plates

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Abstract : The objective of the present paper is to investigate the effect of size on the vibrational behavior of fully clamped rectangular micro-plates based on the modified couple stress theory (MCST). To this end, a size-dependent Kirchhoff plate model is considered and the equation of motion which accounts for the effect of residual and couple stress components is derived using the Hamilton's principle. The eigenvalue problem associated with the free vibrations of fully clamped micro-plates is extracted and solved analytically using the extended Kantorovich method (EKM). The present findings are compared and validated by available results in the literature and an excellent agreement between them is observed. A parametric study is also conducted to show the significant effects of couple stress components on natural frequencies of fully clamped micro-plates. It is found that the ratio of MCST natural frequencies to those obtained by the classical theory (CT) only depends on the Poisson's ratio of the plate and is totally independent of plate's aspect ratio for cases with no residual stresses.

Keywords : vibrational analysis, modified couple stress theory, fully clamped rectangular micro-plates, extended Kantorovich method.

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