A non homogeneous Timoshenko beam subject to the effects due to a diffusion of a fluid

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Abstract

A variational method for a non homogeneous Timoshenko beam with the inclusion of the phenomenon of the diffusion of a fluid is proposed. The axial and bending cases have been analyzed.
In addittion to the classic kinematic descriptors, such as the axial dispacement w, the transversal displacement u and the rotation theta of the section, also the concentration c of the fluid inside the beam has been considered.
The proposed assumption for the elastic strain energy implies the defnition of: (i) the duals, distributed (bˆ{ext}_c) and concentrated (Fˆ{ext}_c0 and Fˆ{ext}_cL), of the descriptor c = c(X; t), (ii) the diusion stifness K_{DIF} , (iii) the fluid elasticity K_F , (iv) the axial-fluid stiffness interaction K_{FN}, (v) the shear-fluid stiffness interaction K_{FT} and (vi) the bending-fluid stiffness interaction K_{FM}.
The dynamic case, with damping by means of the Rayleigh functional, has been considered introducing the damping factors relative to the time derivative of: axial displacement (c_w), the transversal displacement (c_u), the rotation of the section (c_{theta}) and the concentration of fluid (c_c).
Subsequently it will be possible to consider the case of plasticity and damage whose extension to the 2D case will be used in the study of the aging phenomena of dams.

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