Estimates of the eigenvalues of operator arising in swelling pressure model

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Abstract: Swelling pressures from materials confined by structures can cause structural deformations and instability. Due to the complexity of interactions between expansive solid and solid-liquid equilibrium, the forces exerting on retaining structures from swelling are highly nonlinear. In 1994, Mesri and etc. [1], also [2], and [3], developed a simplistic equation for swelling pressure as a function of mobilized volume strain which can be used to show ([4]) that the pressure p acting on a wall can be modeled by $p(x) = p_{sl}e^{-\alpha v(x)}$, where p_{sl} is the swelling pressure against an unyielding wall, α a constant depending upon the solid-liquid equilibrium, and $v(x)$ the deflection of the wall modeled as a cantilever beam at location x along the beam from the fixed end. We consider the initial/boundary value problem of an Euler-Bernoulli elastic beam subject to the swelling pressure with one end clamped and another end free.

In this paper two sided estimates of eigenvalues of the operator corresponding to some nonlinear equation, which is the model of expansive clay are established.

Keywords: Euler-elastic beam equation, Swelling Pressure Model, Estimates of the eigenvalues

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