Approximate solution of a nonlinear beam equation

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Let us consider the differential equation

$$u'''' - m\left(\int_0^l u'^2 dx\right) u'' = f(x,u,u'), \tag{1}$$

$$0 < x < l,\ m(z) \geq \alpha > 0,\ 0 \leq z < \infty,$$

with the boundary conditions

$$u(0) = u(l) = 0,\ u''(0) = u''(l) = 0, \tag{2}$$

which describes the static state of a beam [2]. The solvability of this problem was investigated in [1].

Using (1),(2), we get a nonlinear integral equation which is solved by the Picard iteration method. The convergence of the iteration method is established and the error estimate is obtained.

References

1. Ma, T.F. *Positive solutions for a nonlinear fourth order equation of Kirchhoff type.* Discrete Contin. Din. Syst., (2007), 694–703.
2. Woinowsky-Krieger, S. *The effect of an axial force on the vibration of hinged bars.* J.Appl. Mech. 17, no.1, (1950), 35–36.