Cantilever beam by Gerstmayr and Shabana (2006):

The cantilever beam is originally plane. Beam length is 1 m, square cross-section area is 10-4*f* 2 m2, mass density is 500/*f* 2 kg/m3, Young’s modulus *E* = 108/*f* 4 N/m2, Poisson’s ratio *v* = 0, and *f* is a parameter can be varied. The beam is subjected to its own gravity with *g* = 9.81 m/s2. In the simulation, *f* = 1, analysis time *t* = 0.4s.

Cantilever beam by Dufva et al. (2005):

*E* = 2.07 × 1011 N/m2

*G* = 7.9615 × 1010 N/m2

*v* = 0.3

Shear correction factor *ks* = 5/6

Beam length *L* = 2m.

Case 1: Rectangular cross-sections with *w* = 0.1m and *h* = 0.1m.

Tip load *F* = 1 × 106*h*3 N.

|  |  |  |
| --- | --- | --- |
| At beam free end | u | v |
| Analytical | 0.000 | -0.0015 |
| My simulation | 0.000 | -0.0014 |

Case 2: Rectangular cross-sections with *w* = 0.1m and *h* = 1m.

|  |  |  |
| --- | --- | --- |
| At beam free end | u | v |
| Analytical | 0.000 | -0.0018 |
| My simulation | 0.000 | -0.0024 |

Case 3: Rectangular cross-sections with *w* = 0.01m and *h* = 0.01m. FL^2/EI = 1.5

|  |  |  |
| --- | --- | --- |
| At beam free end | u | v |
| Analytical | -0.216 | -0.882 |
| My simulation | -0.185 | -0.765 |

Case 4: Rectangular cross-sections with *w* = 0.1m and *h* = 0.5m.

Tip load *F* = 500 × 106*h*3 N.

|  |  |  |
| --- | --- | --- |
| At beam free end | u | v |
| Analytical | -0.151 | -0.709 |
| My simulation | -0.161 | -0.734 |

Reference:

1. Gerstmayr, J., & Shabana, A. A. (2006). Analysis of thin beams and cables using the absolute nodal co-ordinate formulation. *Nonlinear Dynamics*, *45*(1-2), 109-130.

2. Dufva, K. E., Sopanen, J. T., & Mikkola, A. M. (2005). A two-dimensional shear deformable beam element based on the absolute nodal coordinate formulation. *Journal of Sound and Vibration*, *280*(3-5), 719-738.