Computational Structural Mechanics and Dynamics

Assignment 6

Beams

By

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Master in numerical method in engineering

Assignment

1. The result obtained after implementing a code for solving Euler Bernoulli and Timoshenko beams are in the table below.

a/l	Max Desplacement			Max Bending Moment			Shear Forces	
	Euler Bernoulli	Reduced Timosenko	Timosenko	Euler Bernoulli	Reduced Timosenko	Timosenko	Reduced Timosenko	Timosenko
0,001	-7,44E+06	-7,44E+06	-9,03E+04	1,9999	1,999	0,0243	1,969	1,969
0,005	-1,19E+04	-1,19E+04	-2,80E+03	1,9999	1,999	0,4698	1,969	1,969
0,01	-7,44E+02	-7,44E+02	-4,10E+02	1,9999	1,999	1,1021	1,969	1,969
0,02	-4,65E+01	-4,65E+01	-3,87E+01	1,9999	1,999	1,6611	1,969	1,969
0,05	-1,19E+00	-1,20E+00	-1,16E+00	1,9999	1,999	1,9360	1,969	1,969
0,1	-7,44E-02	-7,62E-02	-7,56E-02	1,9999	1,999	1,9829	1,969	1,969
0,2	-4,65E-03	-5,09E-03	-5,09E-03	1,9999	1,999	1,9950	1,969	1,969
0,4	-2,91E-04	-4,02E-04	-4,02E-04	1,9999	1,999	1,9980	1,969	1,969

The Figure 1a and Figure 2a corresponding to thin beams show the shear locking effects when it used full integration on Timoshenko beams elements. As it can be seen, this effect produces an over-stiff on the system. On the other hand, Euler-Bernoulli and Timoshenko, using reduced integration, produce accurate result.

The Figure 1b and Figure 2b, corresponding to thick beams, have not shown the shear locking effects. The Figure 1b shows there is no difference between full and reduced integration for Timoshenko beams, while Euler Bernoulli beams gives a less accurate result in comparison with Timoshenko's results.
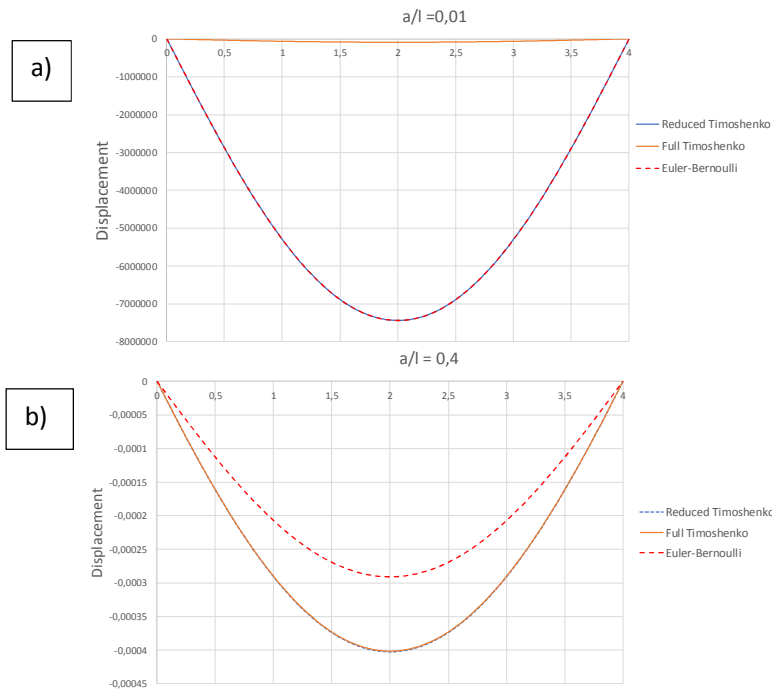

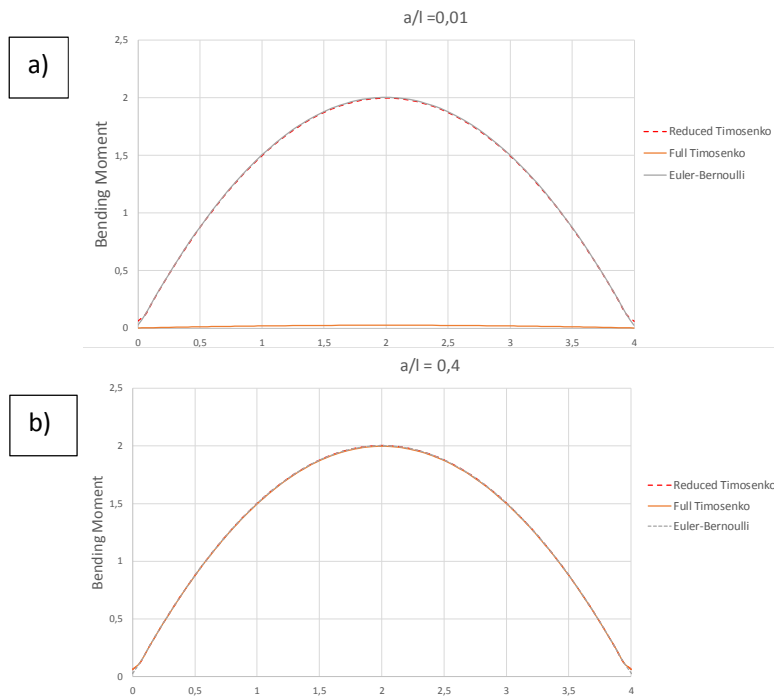Figure 1: Displacement obtained by Euler-Bernoulli, Timoshenko and reduce Timoshenko a) a/l = 0.01, b) a/l = 0.4.

Figure 2: Bending Moment obtained by Euler-Bernoulli, Timoshenko and reduce Timoshenko a) a/l = 0.01, b) a/l = 0.4.