Cantilever Beam Analytical Solution

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1 ANALYTIC RESULTS

Fourth order PDE for the Euler-Bernoulli was solved to obtain natural frequencies and mode shapes for the clampled-free boundary condition (CANTILEVER BEAM). First 10 natural frequencies are listed below and compared to FE results using ABAQUS.

Table 1: Beam Frequencies

| First 8 Natural Frequencies			
Mode	Analytical Resuls	ABAQUS Results	% Error
1	0.0263	0.0261	0.7%
2	0.1647	0.1615	1.9%
3	0.4613	0.4485	2.8%
4	0.9039	0.8749	3.2%
5	1.4942	1.4449	3.3%
6	2.2321	2.1505	3.7%
7	3.1176	2.9235	6.2%
8	4.1507	3.5554	14.3%

Next section compared the mode shapes predicted using the analytical and FE approaches. For 1 and 2 ABAQUS results with 8 noded beam is used.
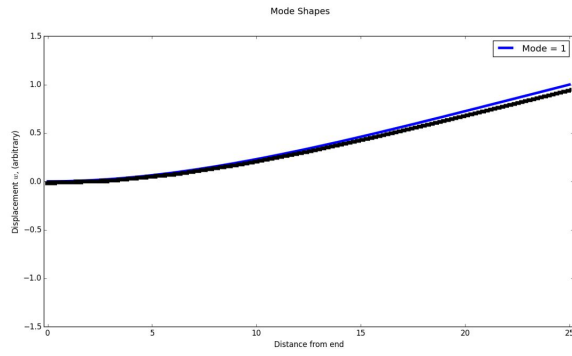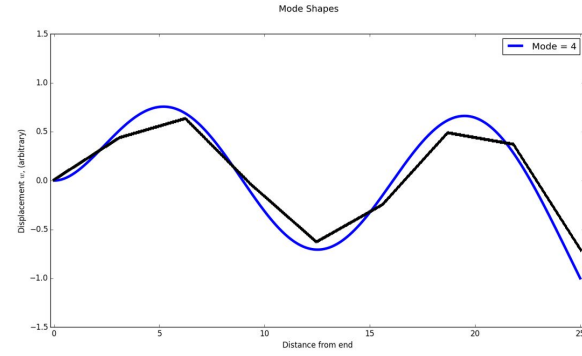
(a) Mode 1 ABAQUS and analytical comparison
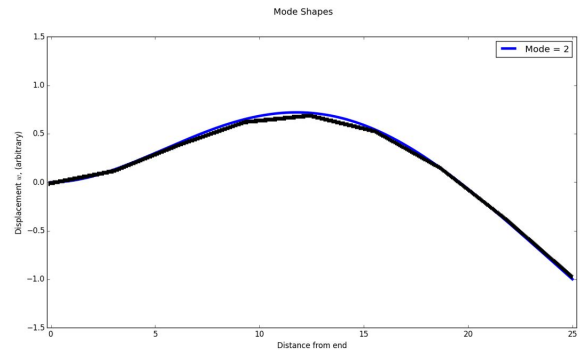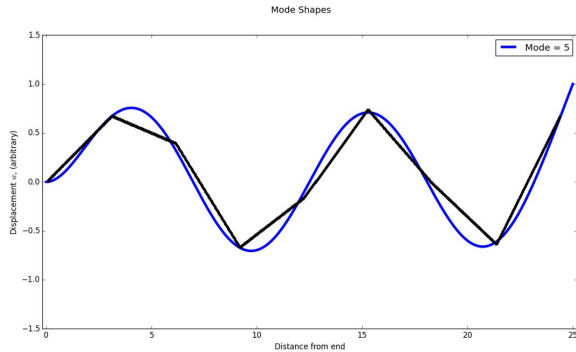
(b) Mode 2 ABAQUS and analytical comparison
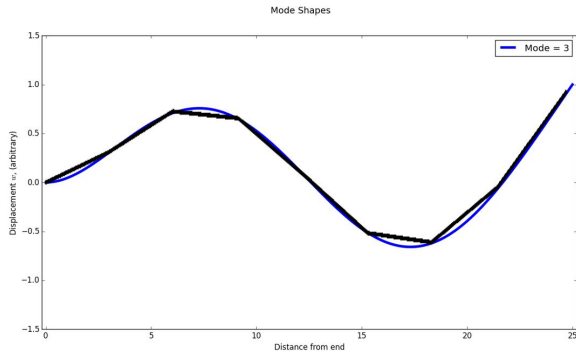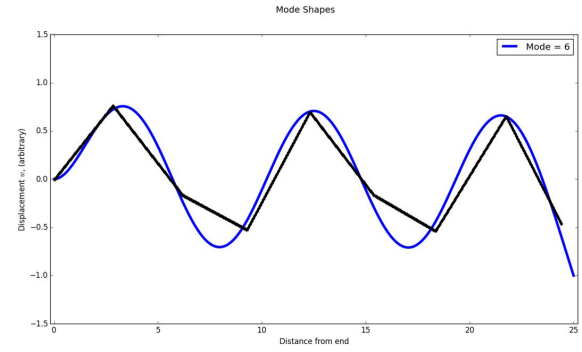
(c) Mode 3 ABAQUS and analytical comparison

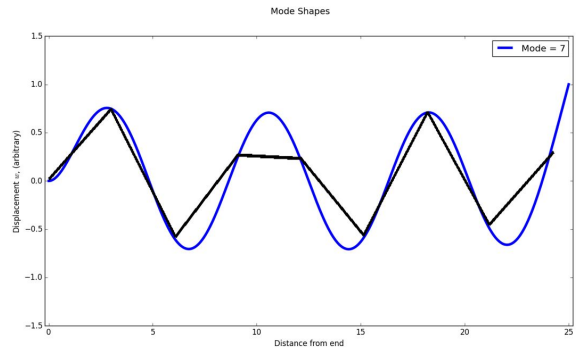(d) Mode 4 ABAQUS and analytical comparison
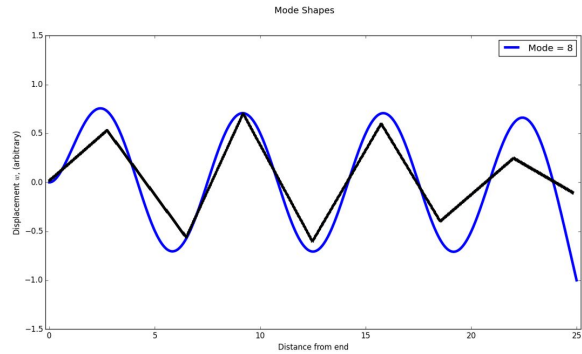
Figure 1: Modes 1 THRU 4

(a) Mode 5 ABAQUS and analytical comparison

(b) Mode 6 ABAQUS and analytical comparison

(c) Mode 7 ABAQUS and analytical comparison

(d) Mode 8 ABAQUS and analytical comparison

Figure 2: Modes 5 THRU 8

Next section compares analytical results to the 2 noded beam element coded in MATLAB.