MEEN 673

Test 1

Jicheng Lu

525004048

Problem 1:

Table 1. Numerical results of Problem 1.

x	DI		NI		Exact
	8L	4Q	8L	4Q	
1.000	1.00000	1.0000	1.00000	1.00000	1.00000
1.125	0.88871	0.88891	0.88866	0.88886	0.88889
1.250	0.79976	0.80010	0.79967	0.80001	0.80000
1.375	0.72704	0.72740	0.72691	0.72727	0.72727
1.500	0.66646	0.66684	0.66630	0.66668	0.66667
1.625	0.61522	0.61558	0.61503	0.61539	0.61538
1.750	0.57132	0.57165	0.57110	0.57144	0.57143
1.875	0.53327	0.53357	0.53304	0.53334	0.53333
2.000	0.49998	0.50025	0.49973	0.50001	0.50000

Problem 2:

Table 2. Numerical results of Problem 2.

x	DI		Exact
	8L	4Q	
0.000	1.00000	1.00000	1.00000
0.125	0.88844	0.88882	0.88889
0.250	0.79935	0.80002	0.80000
0.375	0.72654	0.72727	0.72727
0.500	0.66592	0.66670	0.66667
0.625	0.61466	0.61541	0.61538
0.750	0.57073	0.57147	0.57143
0.875	0.53268	0.53337	0.53333
1.000	0.49939	0.50004	0.50000

Problem 3:

(a) The tangent stiffness coefficients are as follows:

$$T_{ij}^{11} = K_{ij}^{11},\ \ T_{ij}^{13} = K_{ij}^{13},\ \ T_{ij}^{21} = K_{ij}^{21},\ \ T_{ij}^{23} = K_{ij}^{23},\ \ T_{ij}^{31} = K_{ij}^{31},\ \ T_{ij}^{33} = K_{ij}^{33}$$

$$T_{ij}^{12} = 2K_{ij}^{12},\ \ T_{ij}^{32} = K_{ij}^{32},$$

$$T_{ij}^{22} = K_{ij}^{22} + \int_{r_a}^{r_b} \left[A\left(\frac{dw}{dr}\right)^2 \frac{d\psi_i^{(2)}}{dr}\frac{d\psi_j^{(2)}}{dr} \right] rdr + \int_{r_a}^{r_b} A\frac{d\psi_i^{(2)}}{dr}\frac{d\psi_j^{(2)}}{dr}\left[\frac{du}{dr} + \frac{u}{r}\right] rdr$$

(b)

Table 3. Center deflection, w(0), with load, q.

P	Newton Iteration
	10 Quadratic elements
5	11.242
10	17.719
15	22.528
20	26.499
25	29.948
30	33.030
35	35.836
40	38.425
45	40.837
50	43.102
55	45.240
60	47.268
65	49.201
70	51.049
75	52.820
80	54.522
85	56.162
90	57.745
95	59.276
100	60.758
105	62.195
110	63.591
115	64.948
120	66.269

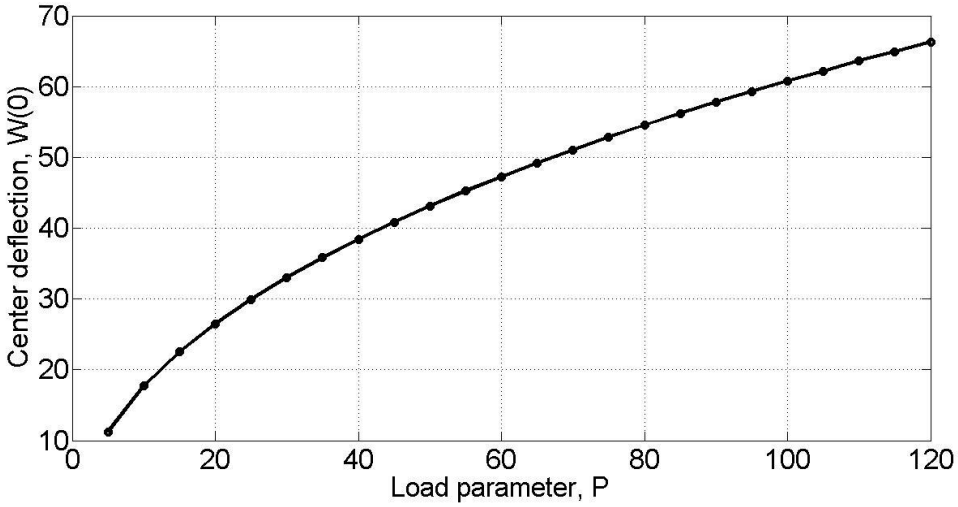

Figure 3.1 Center deflection, w(0), vs load, q.