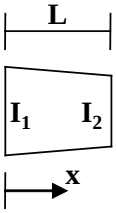
EXAMPLE 1-006

FRAME - NON-PRISMATIC SECTIONS AND AUTOMATIC FRAME SUBDIVISION

EXAMPLE DESCRIPTION

This example tests the SAP2000 non-prismatic frame section property. In SAP2000 the axial (A), torsion (J), weight, and mass properties can vary linearly, and the bending property (I) variation can be linear, parabolic or cubic. The variation of the moment of inertia is defined in SAP2000 as follows:



$$I(x) = \left[\left(I_1^{1/n}\right)\left(1 - \frac{x}{L}\right) + \left(I_2^{1/n}\right)\left(\frac{x}{L}\right) \right]^n$$

where,
n = 1 for linear variation,
n = 2 for parabolic variation, and
n = 3 for cubic variation,

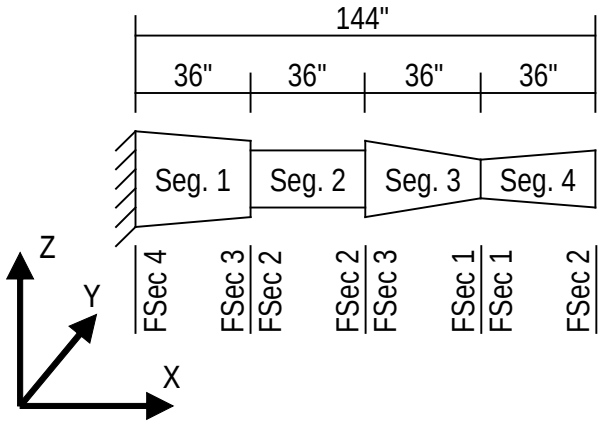
The example model consists of a complex, non-prismatic frame section that is made up of four segments, assigned to a cantilever beam, and subjected to seven load cases, each with a different type of loading. An applicable deformation component at the free end of the cantilever is compared with independent hand calculated results for each load case.

Important Note: Only bending and axial deformations are considered in the analysis. Shear deformations are ignored. In SAP2000 this is achieved by setting the property modification factor for shear area to 0.

This example also tests the frame automatic subdivide feature of SAP2000. The automatic frame subdivide option internally divides the frame object into a user-specified number of elements for the analysis. The analysis results are combined and reported for the entire frame object, not the subdivided elements.

In this example two models are run. Model A has no automatic subdivision. Model B has automatic subdivision that divides the frame object up into 10 equal length elements. The results are compared for each model.

GEOMETRY, PROPERTIES AND LOADING



Material Properties

E = 3,600 k/in^2
v = 0.2
G = 1,500 k/in^2
Unit weight = 0.15 k/ft^3

Segment Definitions

	Segment 1	Segment 2	Segment 3	Segment 4
Start Section	FSec4	FSec2	FSec3	FSec1
End Section	FSec3	FSec2	FSec1	FSec2
Length, in	36	36	36	36
Axial (A) Variation	Linear	Constant	Linear	Linear
Bending (I_{33}) Variation	Linear	Constant	Parabolic	Cubic
Bending (I_{22}) Variation	Linear	Constant	Parabolic	Cubic
Torsion (J) Variation	Linear	Constant	Linear	Linear

Section Properties

	FSec1	FSec2	FSec3	FSec4
Width b, in	12	12	12	12
Depth d, in	12	18	24	30
Area A, in^2	144	216	288	360
Bending I_{33}, in^4	1728	5832	13824	27000
Bending I_{22}, in^4	1728	2592	3456	4320
Torsion J, in^4	2,920.32	6,085.12	9,492.12	12,934.73

Loading

Load Case	Load Type	Value
1	Self weight	Not Applicable
2	F_x at free end (axial)	500 k
3	F_y at free end	5 k
4	F_z at free end	-5 k
5	M_x at free end (torsion)	5,000 k-in
6	M_y at free end	5,000 k-in
7	M_z at free end	5,000 k-in

TECHNICAL FEATURES OF SAP2000 TESTED

- Structural behavior of a non-prismatic frame section
  - Self weight calculations
  - Linear variation of section area
  - Linear, parabolic and cubic variation of moment of inertia
  - Linear variation of section torsional constant
- Automatic frame subdivision

RESULTS COMPARISON

Independent results are hand calculated using the unit load method described on page 244 in Cook and Young 1985.

Results for Model A (With No Automatic Subdivision)

Load Case	Output Parameter	SAP2000	Independent	Percent Difference
1	M_y (fixed end)k-in	-184.950	-184.950	0%
2	U_x (free end) in	0.09087	0.09087	0%
3	U_y (free end) in	0.43120	0.43120	0%
4	U_z (free end) in	-0.14335	-0.14335	0%
5	R_x (free end) rad	0.07987	0.07987	0%
6	R_y (free end) rad	0.03742	0.03742	0%
7	R_z (free end) rad	0.07634	0.07634	0%

Results for Model B (With Automatic Subdivision into Ten Elements)

Load Case	Output Parameter	SAP2000	Independent	Percent Difference
1	M_y (fixed end)k-in	-184.950	-184.950	0%
2	U_x (free end) in	0.09087	0.09087	0%
3	U_y (free end) in	0.43120	0.43120	0%
4	U_z (free end) in	-0.14335	-0.14335	0%
5	R_x (free end) rad	0.07987	0.07987	0%
6	R_y (free end) rad	0.03742	0.03742	0%
7	R_z (free end) rad	0.07634	0.07634	0%

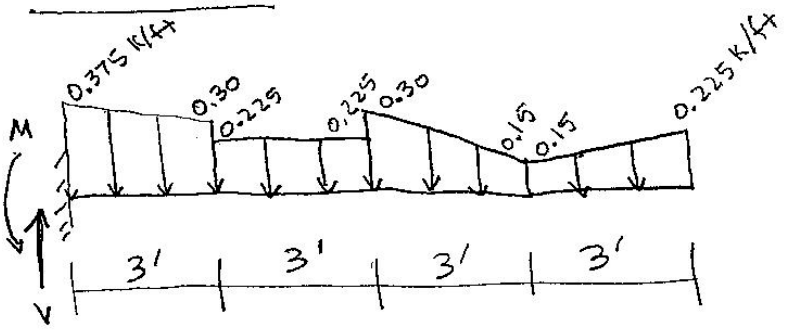
COMPUTER FILE: Example 1-006a, Example 1-006b

CONCLUSION

The SAP2000 results show an exact match with the independent results for both models A and B.

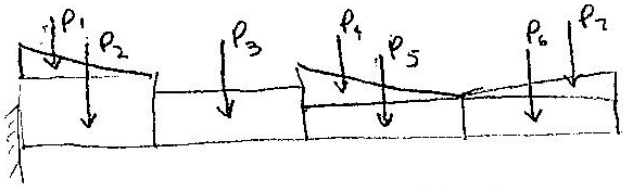
HAND CALCULATION

Load Case 1



$$V = \frac{3(0.375 + 0.30 + 0.225 + 0.225 + 0.30 + 0.15 + 0.15 + 0.225)}{2}$$

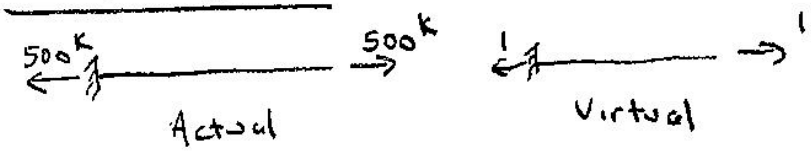
$$V = 2.925^{K}$$



Item	Load (K)	Dist (in)	Moment (K in)
P_1	$0.075 \times 3/2 = 0.1125$	12	1.35
P_2	$0.30 \times 3 = 0.9$	18	16.20
P_3	$0.225 \times 3 = 0.675$	54	36.45
P_4	$0.15 \times 3/2 = 0.225$	84	18.90
P_5	$0.15 \times 3 = 0.45$	90	40.50
P_6	$0.15 \times 3 = 0.45$	126	56.70
P_7	$0.075 \times 3/2 = 0.1125$	132	14.85
		Sum =	184.95

$M_y = -184.95$ K-in

Load Case 2



$$\Delta = \int_0^{36} \left\{ \frac{500}{216\left(1-\frac{x}{36}\right)+144\left(\frac{x}{36}\right)} + \frac{500}{144\left(1-\frac{x}{36}\right)+288\left(\frac{x}{36}\right)} + \frac{500}{216} + \frac{500}{288\left(1-\frac{x}{36}\right)+360\left(\frac{x}{36}\right)} \right\} dx$$

The integral is numerically integrated using Simpons rule in Excel. See next page.

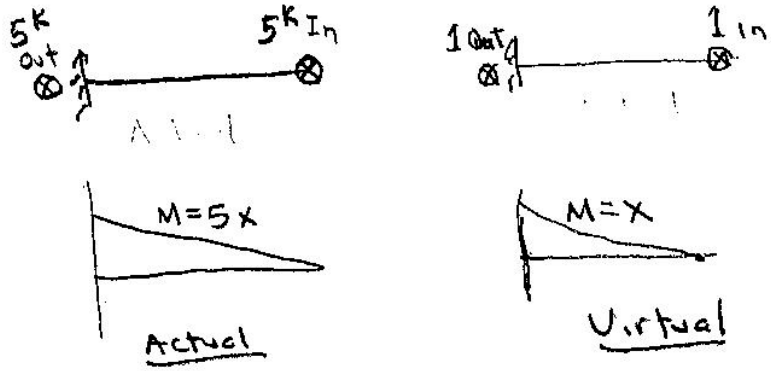
$$\Delta = 0.09087$$

Verification Example 1-006 - Load Case 2

Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) *dX$

Pt	Dist	Function	G	Function/G	Simpsons Rule
0	0	9.837963	3600	0.002732767	0.000910922
1	1	9.75378	3600	0.002709383	0.003612511
2	2	9.675108	3600	0.00268753	0.001791687
3	3	9.601576	3600	0.002667104	0.003556139
4	4	9.53285	3600	0.002648014	0.001765343
5	5	9.468632	3600	0.002630176	0.003506901
6	6	9.408652	3600	0.002613515	0.001742343
7	7	9.352668	3600	0.002597963	0.003463951
8	8	9.300461	3600	0.002583461	0.001722308
9	9	9.251832	3600	0.002569953	0.003426604
10	10	9.206603	3600	0.00255739	0.001704927
11	11	9.164612	3600	0.002545726	0.003394301
12	12	9.125712	3600	0.00253492	0.001689947
13	13	9.089771	3600	0.002524936	0.003366582
14	14	9.056668	3600	0.002515741	0.001677161
15	15	9.026294	3600	0.002507304	0.003343072
16	16	8.998552	3600	0.002499598	0.001666399
17	17	8.973353	3600	0.002492598	0.003323464
18	18	8.950617	3600	0.002486283	0.001657522
19	19	8.930273	3600	0.002480631	0.003307509
20	20	8.912257	3600	0.002475627	0.001650418
21	21	8.896512	3600	0.002471253	0.003295004
22	22	8.882988	3600	0.002467497	0.001644998
23	23	8.871641	3600	0.002464345	0.003285793
24	24	8.862434	3600	0.002461787	0.001641191
25	25	8.855333	3600	0.002459815	0.003279753
26	26	8.850313	3600	0.00245842	0.001638947
27	27	8.84735	3600	0.002457597	0.003276796
28	28	8.846428	3600	0.002457341	0.001638227
29	29	8.847535	3600	0.002457649	0.003276865
30	30	8.850664	3600	0.002458518	0.001639012
31	31	8.855811	3600	0.002459948	0.00327993
32	32	8.862978	3600	0.002461938	0.001641292
33	33	8.872172	3600	0.002464492	0.00328599
34	34	8.883402	3600	0.002467612	0.001645074
35	35	8.896684	3600	0.002471301	0.003295068
36	36	8.912037	3600	0.002475566	0.000825189
				Sum	**0.090869138**

Load Case 3



$$\Delta = \frac{1}{E}\int_0^{36}\left\{\frac{5x^2}{\left[2592^{1/3}\left(1-\frac{x}{36}\right)+1728^{1/3}\left(\frac{x}{36}\right)\right]^3}\right.$$

$$+\frac{5(x+36)^2}{\left[1728^{1/2}\left(1-\frac{x}{36}\right)+3456^{1/2}\left(\frac{x}{36}\right)\right]^2}$$

$$+\frac{5(x+72)^2}{2592}$$

$$\left.+\frac{5(x+108)^2}{3456\left(1-\frac{x}{36}\right)+4320\left(\frac{x}{36}\right)}\right\}dx$$

The integral is numerically integrated using Simpsons rule in Excel. See next page.

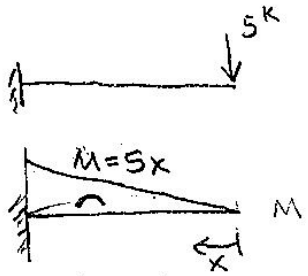
$\Delta = 0.43120$

Verification Example 1-006 - Load Case 3

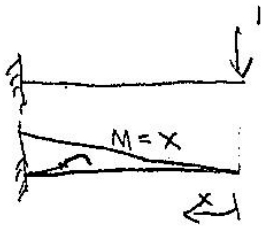
Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) * dX$

Pt	Dist	Function	E	Function/E	Simpsons Rule
0	0	30.625	3600	0.008506944	0.002835648
1	1	31.22368	3600	0.008673244	0.011564326
2	2	31.82952	3600	0.008841532	0.005894355
3	3	32.4426	3600	0.009011834	0.012015778
4	4	33.06303	3600	0.009184175	0.006122784
5	5	33.69091	3600	0.009358587	0.012478116
6	6	34.32636	3600	0.0095351	0.006356734
7	7	34.96949	3600	0.009713748	0.012951664
8	8	35.62044	3600	0.009894567	0.006596378
9	9	36.27933	3600	0.010077592	0.01343679
10	10	36.94631	3600	0.010262865	0.00684191
11	11	37.62153	3600	0.010450426	0.013933901
12	12	38.30514	3600	0.010640317	0.007093545
13	13	38.9973	3600	0.010832584	0.014443446
14	14	39.69819	3600	0.011027274	0.007351516
15	15	40.40796	3600	0.011224434	0.014965911
16	16	41.12681	3600	0.011424114	0.007616076
17	17	41.85492	3600	0.011626368	0.015501824
18	18	42.5925	3600	0.011831249	0.007887499
19	19	43.33972	3600	0.012038812	0.016051749
20	20	44.09682	3600	0.012249116	0.008166077
21	21	44.86399	3600	0.01246222	0.016616293
22	22	45.64147	3600	0.012678185	0.008452123
23	23	46.42947	3600	0.012897076	0.017196101
24	24	47.22825	3600	0.013118957	0.008745972
25	25	48.03803	3600	0.013343898	0.017791863
26	26	48.85908	3600	0.013571966	0.009047977
27	27	49.69164	3600	0.013803235	0.018404313
28	28	50.536	3600	0.014037778	0.009358518
29	29	51.39242	3600	0.014275671	0.019034228
30	30	52.26118	3600	0.014516994	0.009677996
31	31	53.14258	3600	0.014761828	0.019682437
32	32	54.03692	3600	0.015010256	0.010006837
33	33	54.94451	3600	0.015262363	0.020349818
34	34	55.86566	3600	0.01551824	0.010345493
35	35	56.80071	3600	0.015777976	0.021037302
36	36	57.75	3600	0.016041667	0.005347222
				Sum	**0.431200523**

Load Case 4



Actual



Virtual

$$\Delta = \frac{1}{E}\int_0^{36}\left\{\frac{5x^2}{\left[5832^{1/3}\left(1-\frac{x}{36}\right)+1728^{1/3}\left(\frac{x}{36}\right)\right]^3}\right.$$

$$+\frac{5(x+36)^2}{\left[1728^{1/2}\left(1-\frac{x}{36}\right)+13824^{1/2}\left(\frac{x}{36}\right)\right]^2}$$

$$+\frac{5(x+72)^2}{5832}$$

$$\left.+\frac{5(x+108)^2}{13824\left(1-\frac{x}{36}\right)+27000\left(\frac{x}{36}\right)}\right\}dx$$

The integral is numerically integrated using Simpsons rule in Excel. See next page.

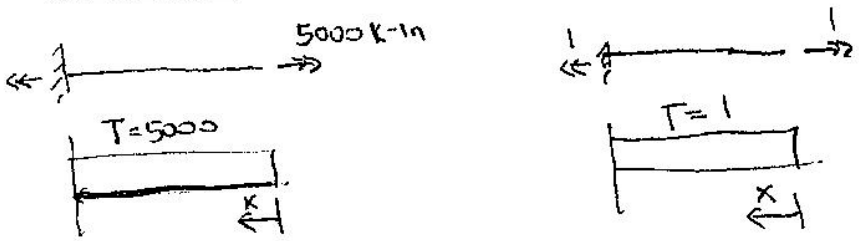
$$\Delta = +0.14335$$

Verification Example 1-006 - Load Case 4

Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) *dX$

Pt	Dist	Function	E	Function/E	Simpsons Rule
0	0	12.41319	3600	0.00344811	0.00114937
1	1	12.34359	3600	0.003428775	0.0045717
2	2	12.29797	3600	0.003416104	0.002277403
3	3	12.27355	3600	0.003409319	0.004545758
4	4	12.26808	3600	0.003407799	0.002271866
5	5	12.27977	3600	0.003411048	0.004548064
6	6	12.30719	3600	0.003418664	0.002279109
7	7	12.34917	3600	0.003430325	0.004573767
8	8	12.40479	3600	0.003445776	0.002297184
9	9	12.47332	3600	0.003464812	0.004619749
10	10	12.55419	3600	0.003487275	0.00232485
11	11	12.64696	3600	0.003513044	0.004684059
12	12	12.75133	3600	0.003542035	0.002361357
13	13	12.86709	3600	0.00357419	0.004765587
14	14	12.99413	3600	0.003609481	0.00240632
15	15	13.13244	3600	0.003647901	0.004863868
16	16	13.28209	3600	0.003689468	0.002459646
17	17	13.4432	3600	0.003734223	0.004978964
18	18	13.61601	3600	0.003782225	0.002521483
19	19	13.8008	3600	0.003833555	0.005111407
20	20	13.99793	3600	0.003888315	0.00259221
21	21	14.20786	3600	0.003946627	0.005262169
22	22	14.43108	3600	0.004008634	0.002672422
23	23	14.6682	3600	0.004074501	0.005432668
24	24	14.9199	3600	0.004144416	0.002762944
25	25	15.18693	3600	0.004218593	0.005624791
26	26	15.47017	3600	0.004297269	0.002864846
27	27	15.77056	3600	0.00438071	0.005840947
28	28	16.08917	3600	0.004469213	0.002979475
29	29	16.42717	3600	0.004563103	0.006084138
30	30	16.78588	3600	0.004662745	0.003108497
31	31	17.16674	3600	0.004768538	0.006358051
32	32	17.57133	3600	0.004880925	0.00325395
33	33	18.00142	3600	0.005000394	0.006667192
34	34	18.45893	3600	0.005127481	0.003418321
35	35	18.94601	3600	0.00526278	0.00701704
36	36	19.465	3600	0.005406944	0.001802315
				Sum	**0.143353486**

Load Case 5



Actual

Virtual

$$\theta = \frac{1}{G}\int_0^{36}\left\{\frac{5000}{6085.12\left(1-\frac{x}{36}\right)+2920.32\left(\frac{x}{36}\right)}\right.$$

$$+\frac{5000}{2920.32\left(1-\frac{x}{36}\right)+9492.12\left(\frac{x}{36}\right)}$$

$$+\frac{5000}{6085.12}$$

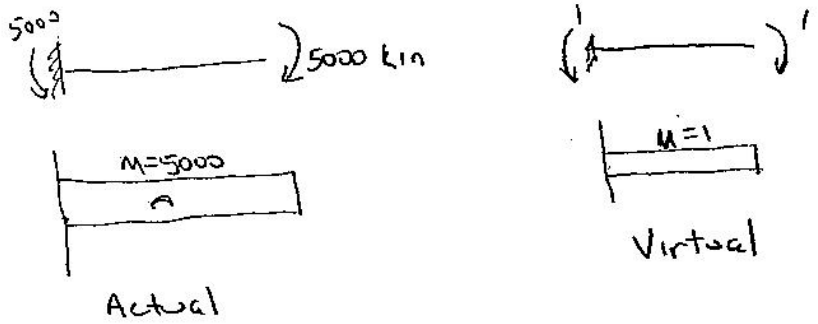
$$\left.+\frac{5000}{9492.12\left(1-\frac{x}{36}\right)+12934.73\left(\frac{x}{36}\right)}\right\}dx$$

The integral is numerically integrated using Simpon's rule in Excel. See next page.

$$\theta = 0.07987$$

Verification Example 1-006 - Load Case 5						
Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) * dX$						
Pt	**Dist**	**Function**	**G**	**Function/G**	**Simpsons Rule**	
0	0	3.882247	1500	0.002588165	0.000862722	
1	1	3.788308	1500	0.002525539	0.003367385	
2	2	3.706025	1500	0.002470683	0.001647122	
3	3	3.633644	1500	0.002422429	0.003229905	
4	4	3.569764	1500	0.002379842	0.001586562	
5	5	3.513256	1500	0.002342171	0.003122895	
6	6	3.463202	1500	0.002308801	0.001539201	
7	7	3.418844	1500	0.002279229	0.003038972	
8	8	3.379558	1500	0.002253039	0.001502026	
9	9	3.344824	1500	0.002229883	0.002973177	
10	10	3.314206	1500	0.002209471	0.00147298	
11	11	3.287338	1500	0.002191559	0.002922078	
12	12	3.263913	1500	0.002175942	0.001450628	
13	13	3.24367	1500	0.002162447	0.002883262	
14	14	3.226391	1500	0.002150927	0.001433952	
15	15	3.211891	1500	0.002141261	0.002855015	
16	16	3.200017	1500	0.002133345	0.00142223	
17	17	3.190639	1500	0.002127093	0.002836124	
18	18	3.183654	1500	0.002122436	0.001414957	
19	19	3.178975	1500	0.002119317	0.002825756	
20	20	3.176537	1500	0.002117692	0.001411794	
21	21	3.176291	1500	0.002117527	0.00282337	
22	22	3.178202	1500	0.002118801	0.001412534	
23	23	3.182252	1500	0.002121501	0.002828668	
24	24	3.188436	1500	0.002125624	0.001417083	
25	25	3.196763	1500	0.002131176	0.002841568	
26	26	3.207257	1500	0.002138171	0.001425448	
27	27	3.219954	1500	0.002146636	0.002862181	
28	28	3.234904	1500	0.002156603	0.001437735	
29	29	3.252174	1500	0.002168116	0.002890822	
30	30	3.271845	1500	0.00218123	0.001454153	
31	31	3.294014	1500	0.002196009	0.002928013	
32	32	3.318798	1500	0.002212532	0.001475021	
33	33	3.346331	1500	0.002230887	0.002974516	
34	34	3.376771	1500	0.002251181	0.001500787	
35	35	3.4103	1500	0.002273533	0.003031378	
36	36	3.447127	1500	0.002298084	0.000766028	
				Sum	**0.079868047**	

Load Case 6



$$\theta = \frac{1}{E}\int_0^{36} \left\{ \frac{5000}{\left[5832^{1/3}\left(1-\frac{x}{36}\right)+1728^{1/3}\left(\frac{x}{36}\right)\right]^3} + \frac{5000}{\left[1728^{1/2}\left(1-\frac{x}{36}\right)+13824^{1/2}\left(\frac{x}{36}\right)\right]^2} + \frac{5000}{5832} + \frac{5000}{13824\left(1-\frac{x}{36}\right)+27000\left(\frac{x}{36}\right)} \right\} dx$$

The integral is numerically integrated using Simpsons rule in Excel. See next page.

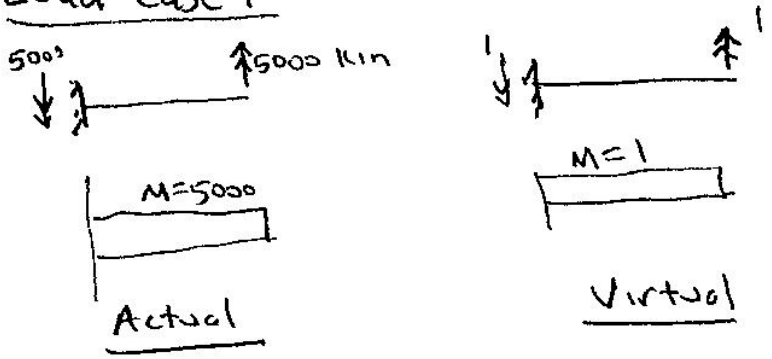
$$\theta = 0.03742$$

Verification Example 1-006 - Load Case 6

Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) * dX$

Pt	Dist	Function	E	Function/E	Simpsons Rule
0	0	4.969886	3600	0.001380524	0.000460175
1	1	4.711865	3600	0.001308851	0.001745135
2	2	4.492114	3600	0.00124781	0.000831873
3	3	4.304289	3600	0.001195636	0.001594181
4	4	4.14336	3600	0.001150933	0.000767289
5	5	4.005308	3600	0.001112585	0.001483447
6	6	3.886886	3600	0.001079691	0.000719794
7	7	3.785457	3600	0.001051516	0.001402021
8	8	3.698863	3600	0.001027462	0.000684975
9	9	3.625324	3600	0.001007034	0.001342712
10	10	3.56337	3600	0.000989825	0.000659883
11	11	3.51178	3600	0.000975495	0.001300659
12	12	3.469537	3600	0.00096376	0.000642507
13	13	3.43579	3600	0.000954386	0.001272515
14	14	3.409831	3600	0.000947175	0.00063145
15	15	3.391067	3600	0.000941963	0.001255951
16	16	3.379007	3600	0.000938613	0.000625742
17	17	3.373244	3600	0.000937012	0.00124935
18	18	3.373444	3600	0.000937068	0.000624712
19	19	3.379336	3600	0.000938704	0.001251606
20	20	3.390706	3600	0.000941863	0.000627909
21	21	3.40739	3600	0.000946497	0.001261996
22	22	3.429268	3600	0.000952574	0.00063505
23	23	3.456259	3600	0.000960072	0.001280096
24	24	3.488323	3600	0.000968979	0.000645986
25	25	3.525452	3600	0.000979292	0.001305723
26	26	3.567671	3600	0.00099102	0.00066068
27	27	3.615038	3600	0.001004177	0.001338903
28	28	3.667642	3600	0.001018789	0.000679193
29	29	3.7256	3600	0.001034889	0.001379852
30	30	3.789062	3600	0.001052517	0.000701678
31	31	3.858208	3600	0.001071724	0.001428966
32	32	3.933247	3600	0.001092569	0.000728379
33	33	4.014424	3600	0.001115118	0.001486824
34	34	4.102016	3600	0.001139449	0.000759633
35	35	4.196335	3600	0.001165649	0.001554198
36	36	4.297732	3600	0.001193815	0.000397938
				Sum	**0.037418979**

Load Case 7



$$\theta = \frac{1}{E}\int_0^{36}\left\{\frac{5000}{\left[2592^{1/3}\left(1-\frac{x}{36}\right)+1728^{1/3}\left(\frac{x}{36}\right)\right]^3}\right.$$

$$+\frac{5000}{\left[1728^{1/2}\left(1-\frac{x}{36}\right)+3456^{1/2}\left(\frac{x}{36}\right)\right]^2}$$

$$+\frac{5000}{2592}$$

$$\left.+\frac{5000}{3456\left(1-\frac{x}{36}\right)+4320\left(\frac{x}{L}\right)}\right\}dx$$

The integral is numerically integrated using Simpsons rule in Excel. See next page

$$\theta = 0.07634$$

Verification Example 1-006 - Load Case 7

Simpsons Rule: $(X_0/3 + 4X_1/3 + 2X_2/3 + 4X_3/3 + \ldots + 2X_{N-2}/3 + 4X_{N-1}/3 + X_N/3) * dX$

Pt	Dist	Function	E	Function/E	Simpsons Rule
0	0	8.198302	3600	0.002277306	0.000759102
1	1	8.143337	3600	0.002262038	0.003016051
2	2	8.090995	3600	0.002247499	0.001498332
3	3	8.041181	3600	0.002233661	0.002978215
4	4	7.993807	3600	0.002220502	0.001480335
5	5	7.948787	3600	0.002207996	0.002943995
6	6	7.906044	3600	0.002196123	0.001464082
7	7	7.865501	3600	0.002184861	0.002913149
8	8	7.827089	3600	0.002174191	0.001449461
9	9	7.790742	3600	0.002164095	0.00288546
10	10	7.756396	3600	0.002154554	0.00143637
11	11	7.723992	3600	0.002145553	0.002860738
12	12	7.693475	3600	0.002137076	0.001424718
13	13	7.664792	3600	0.002129109	0.002838812
14	14	7.637893	3600	0.002121637	0.001414425
15	15	7.612733	3600	0.002114648	0.002819531
16	16	7.589266	3600	0.002108129	0.00140542
17	17	7.567451	3600	0.00210207	0.00280276
18	18	7.54725	3600	0.002096458	0.001397639
19	19	7.528624	3600	0.002091285	0.002788379
20	20	7.511541	3600	0.002086539	0.001391026
21	21	7.495967	3600	0.002082213	0.002776284
22	22	7.481872	3600	0.002078298	0.001385532
23	23	7.469226	3600	0.002074785	0.00276638
24	24	7.458004	3600	0.002071668	0.001381112
25	25	7.448179	3600	0.002068939	0.002758585
26	26	7.439729	3600	0.002066592	0.001377728
27	27	7.432632	3600	0.00206462	0.002752827
28	28	7.426867	3600	0.002063018	0.001375346
29	29	7.422414	3600	0.002061782	0.002749042
30	30	7.419257	3600	0.002060905	0.001373937
31	31	7.41738	3600	0.002060383	0.002747178
32	32	7.416766	3600	0.002060213	0.001373475
33	33	7.417403	3600	0.00206039	0.002747186
34	34	7.419278	3600	0.002060911	0.00137394
35	35	7.42238	3600	0.002061772	0.002749029
36	36	7.426698	3600	0.002062972	0.000687657
				Sum	**0.076343235**