MEEN-673 Nonlinear Finite Element Analysis Assignment-5

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Please follow the order and format used here. Just fill out the values of in the corresponding tables for each problem. If you have any plots that you want to include, include them at the end of each problem and name them appropriately.

Problem 1 :Simply Supported plate (SS-3)

Input files for Problem 1 goes here. Example:

Problem 1a: Simply supported(SS3) plate 8X8 L4

1	MODEL (Not used)
4 2 1 1 NA NA NA 1 2	NPE,NGPF,NGPR,NGPS,NSTR,MESH,NPRNT,IGRAD,NONLIN
3	SS
8 8	NX,NY
0 0.625 0.625 0.625 0.625 0.625 0.625 0.625 0.625	XO,DX(I)
0 0.625 0.625 0.625 0.625 0.625 0.625 0.625 0.625	YO,DY(I)
84	NSPV
zeros(NSPV,1)	VSPV
Table	ISPV

Problem 1b: Simply supported(SS3) plate 4X4 Q9

2	MODEL (Not Used)
9 3 2 2 NA NA NA 1 2	NPE,NGPF,NGPR,NGPS,NSTR,MESH,NPRNT,IGRAD,NONLIN
3	SS
4 4	NX,NY
0 1.25 1.25 1.25 1.25	XO,DX(I)
0 1.25 1.25 1.25 1.25	YO,DY(I)
84	NSPV
zeros(NSPV,1)	VSPV
Table	ISPV

Problem 2 : Clamped square plate

Input files for problem 2 goes here. Example

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Problem 2a:     Clamped  plate 8X8  L4

1                                MODEL (Not Used)
4 2  1  1  NA NA  NA 0 1  2      NPE,NGPF,NGPR,NGPS,NSTR,MESH,NPRNT,IGRAD,NONLIN
                            4    SS
117                               NX,NY
0  0.625 0.625    0.625     0.625  0.625  0.625  0.625  0.625      XO,DX(I)
0  0.625 0.625    0.625     0.625  0.625  0.625  0.625  0.625      YO,DY(I)

117                      NSPV
zeros(NSPV,1)            VSPV
Table                    ISPV
```

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Problem 2b: Clamped plate 4X4 Q9

2                                          MODEL
9  3  2  2 NA NA  0  1  2        NPE,NGPF,NGPR,NGPS,NSTR,MESH,NPRNT,IGRAD,NONLIN
                           4     SS

4  4                               NX,NY
0  1.25    1.25  1.25   1.25     XO,DX(I)
0  1.25    1.25  1.25   1.25     YO,DY(I)

117                      NSPV
zeros(NSPV,1)            VSPV
Table                    ISPV
```

Load Parameter (P)	SS - 3 8*8 L4 (w/h)	SS - 3 4*4 Q9 (w/h)	Clamped 8*8 L4 (w/h)	Clamped 4*4 Q9 (w/h)
0.15625	0.172027	0.16667	0.051358	0.051456
0.3125	0.308954	0.30017	0.102226	0.102401
0.46875	0.413766	0.40286	0.152155	0.152371
0.625	0.497089	0.4847	0.200778	0.200986
0.78125	0.566082	0.55258	0.247819	0.247969
0.9375	0.625051	0.61066	0.293101	0.293141
1.09375	0.676668	0.66154	0.336531	0.336417
1.25	0.722678	0.70692	0.378086	0.377777
1.40625	0.764272	0.74797	0.41779	0.417257
1.5625	0.802297	0.78552	0.455705	0.454923
1.71875	0.837379	0.82017	0.491915	0.490866
1.875	0.869988	0.8524	0.526512	0.525185
2.03125	0.90049	0.88255	0.559595	0.557983
2.1875	0.929175	0.91092	0.591264	0.589363
2.34375	0.956274	0.93772	0.621614	0.619422
2.5	0.981977	0.96315	0.650735	0.648255
2.65625	1.00644	0.98737	0.678714	0.675947
2.8125	1.029797	1.01049	0.70563	0.702581
2.96875	1.052156	1.03263	0.731556	0.728229
3.125	1.073614	1.05388	0.75656	0.752961
3.28125	1.094251	1.07433	0.780703	0.776838
3.4375	1.114139	1.09403	0.804043	0.799917
3.59375	1.133338	1.11306	0.82663	0.822251
3.75	1.151903	1.13146	0.848514	0.843887
3.90625	1.169881	1.14928	0.869736	0.864869
4.0625	1.187316	1.16657	0.890339	0.885237
4.21875	1.204244	1.18336	0.910357	0.905026
4.375	1.220701	1.19968	0.929825	0.924272
4.53125	1.236715	1.21557	0.948774	0.943004
4.6875	1.252316	1.23104	0.967233	0.961252
4.84375	1.267527	1.24614	0.985228	0.979041
5	1.282371	1.26087	1.002783	0.996397

Table 1: Load parameter versus $\frac{w}{h}$ for both SS-3 and clamped plates (Deflection at centre, ie x =0 , y = 0)

Load Parameter (P)	SS-3 8*8 L4				
	σ_{xx}	σ_{yy}	σ_{xy}	σ_{yz}	σ_{xz}
0.15625	73118.11231	25839.48	4.614969	-2476.99	-1800.75
0.3125	138055.2533	48907.21	61.36717	-4262.78	-3137.71
0.46875	191616.6951	67889.95	140.0896	-5439.38	-4061.35
0.625	236552.2295	83753.64	222.76	-6230.4	-4718.86
0.78125	275346.4956	97399.86	302.6116	-6780.42	-5206.52
0.9375	309658.9068	109434.7	377.4598	-7173.16	-5580.74
1.09375	340581.3114	120257.2	446.8365	-7458.56	-5875.58
1.25	368854.6433	130137.9	510.9118	-7667.89	-6112.62
1.40625	395000.4386	139266.7	570.0783	-7821.62	-6306.22
1.5625	419398.3798	147781.3	624.7853	-7933.68	-6466.3
1.71875	442333.0889	155784.4	675.4729	-8013.89	-6599.95
1.875	464023.3422	163355	722.5466	-8069.32	-6712.38
2.03125	484640.9519	170554.4	766.3703	-8105.23	-6807.51
2.1875	504323.7283	177431.9	807.2702	-8125.56	-6888.35
2.34375	523182.5762	184026.9	845.5221	-8133.36	-6957.27
2.5	541310.0716	190372	881.3811	-8130.98	-7016.12
2.65625	558783.0597	196494.5	915.0672	-8120.28	-7066.41
2.8125	575666.3691	202416.9	946.7746	-8102.76	-7109.37
2.96875	592015.2226	208158.6	976.6747	-8079.6	-7145.99
3.125	607877.0696	213736.1	1004.92	-8051.78	-7177.11
3.28125	623292.9994	219163.7	1031.645	-8020.09	-7203.44
3.4375	638298.8462	224453.7	1056.97	-7985.19	-7225.55
3.59375	652926.0618	229616.9	1081.004	-7947.62	-7243.96
3.75	667202.4143	234662.9	1103.843	-7907.84	-7259.09
3.90625	681152.5512	239600.2	1125.573	-7866.22	-7271.3
4.0625	694798.4586	244436.1	1146.274	-7823.08	-7280.92
4.21875	708159.8376	249177.4	1166.016	-7778.7	-7288.22
4.375	721254.4169	253830.1	1184.863	-7733.3	-7293.45
4.53125	734098.2123	258399.6	1202.874	-7687.08	-7296.81
4.6875	746705.7454	262890.9	1220.101	-7640.21	-7298.49
4.84375	759090.2271	267308.3	1236.595	-7592.83	-7298.66
5	771263.7149	271655.9	1252.397	-7545.06	-7297.45

Table 2: Load parameter versus stresses for SS-3 8X8 L4 (at center)

Load Paramete	SS-3 4*4 Q9				
	σ_{xx}	σ_{yy}	σ_{xy}	σ_{yz}	σ_{xz}
0.15625	31831.94	17826.34	-4964.8	-1976.2	-393.791
0.3125	60237.77	35967.39	-9004.54	-3539.5	-672.704
0.46875	84195.96	52814.36	-12167	-4717.02	-845.02
0.625	104783.1	68288.35	-14735.8	-5632.1	-945.729
0.78125	122946.9	82605.26	-16907.5	-6370.26	-999.05
0.9375	139319.3	95973.58	-18801.1	-6983.82	-1019.79
1.09375	154317.5	108556.6	-20490.6	-7505.66	-1017.22
1.25	168226.5	120478.5	-22024.3	-7957.4	-997.454
1.40625	181248.1	131834.8	-23435.3	-8353.96	-964.662
1.5625	193530.5	142700.3	-24746.8	-8706.02	-921.823
1.71875	205186	153134.5	-25976.2	-9021.46	-871.117
1.875	216301.4	163185.7	-27136.4	-9306.29	-814.188
2.03125	226945.7	172893.8	-28237.5	-9565.17	-752.297
2.1875	237174.8	182292.3	-29287.4	-9801.78	-686.433
2.34375	247033.8	191408.8	-30292.4	-10019.1	-617.371
2.5	256561.1	200267.9	-31257.9	-10219.6	-545.744
2.65625	265788.5	208890.2	-32188.1	-10405.2	-472.062
2.8125	274743.4	217294	-33086.6	-10577.7	-396.745
2.96875	283449.1	225495	-33956.4	-10738.4	-320.137
3.125	291925.9	233507.5	-34800.2	-10888.6	-242.526
3.28125	300191.4	241343.8	-35620.2	-11029.3	-164.153
3.4375	308261.3	249015.1	-36418.4	-11161.5	-85.2194
3.59375	316149.3	256531.5	-37196.4	-11285.8	-5.89618
3.75	323867.6	263902	-37955.8	-11403	73.67192
3.90625	331427.1	271134.7	-38697.8	-11513.7	153.362
4.0625	338837.7	278237.3	-39423.6	-11618.5	233.0692
4.21875	346108.2	285216.3	-40134.4	-11717.7	312.7041
4.375	353246.7	292078.2	-40830.9	-11811.9	392.1903
4.53125	360260.5	298828.7	-41514.2	-11901.4	471.4622
4.6875	367156.1	305472.9	-42184.9	-11986.5	550.464
4.84375	373939.8	312015.9	-42843.7	-12067.6	629.1477
5	380617	318462	-43491.3	-12144.9	707.4725

Table 3: Load parameter versus stresses for SS-3 4X4 Q9 (at center)

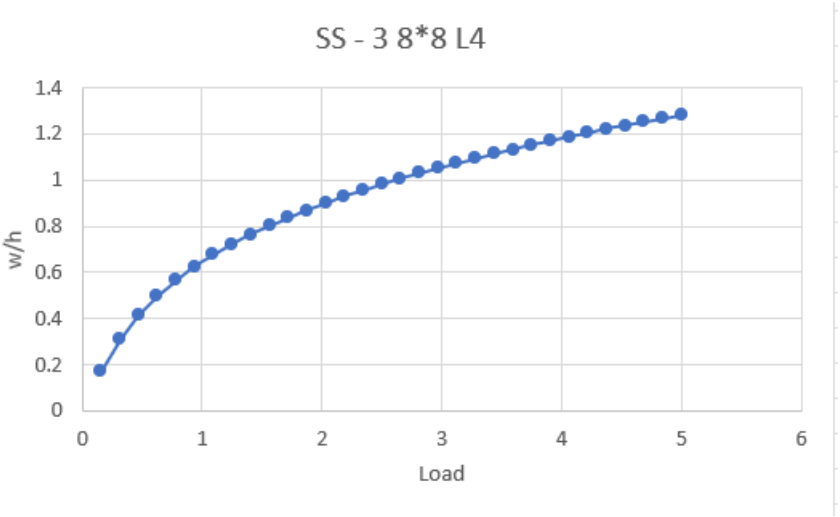
Load Paramete	Clamped 8*8 L4				
	σ_{xx}	σ_{yy}	σ_{xy}	σ_{yz}	σ_{xz}
0.15625	24107.77	9392.815	-289.808	-349.206	-355.108
0.3125	48871.92	19068.33	-570.635	-687.846	-704.139
0.46875	74001.61	28904.4	-839.082	-1006.48	-1041.62
0.625	99223.71	38785.78	-1092.74	-1297.62	-1363.15
0.78125	124302.1	48612.41	-1330.22	-1556.18	-1665.6
0.9375	149047.3	58303.76	-1551.09	-1779.36	-1947.12
1.09375	173318.7	67799.75	-1755.6	-1966.41	-2207
1.25	197019.3	77058.98	-1944.55	-2118.08	-2445.37
1.40625	220089.6	86055.78	-2119.01	-2236.21	-2662.98
1.5625	242498.7	94776.87	-2280.23	-2323.25	-2860.99
1.71875	264237.3	103218.1	-2429.49	-2381.98	-3040.75
1.875	285311.5	111382.1	-2568.03	-2415.27	-3203.73
2.03125	305737.5	119275.7	-2697	-2425.91	-3351.37
2.1875	325538.3	126908.6	-2817.48	-2416.55	-3485.08
2.34375	344740.8	134292.3	-2930.43	-2389.65	-3606.18
2.5	363373.4	141439.2	-3036.7	-2347.41	-3715.88
2.65625	381465.7	148361.6	-3137.04	-2291.84	-3815.3
2.8125	399046.8	155072.3	-3232.13	-2224.71	-3905.45
2.96875	416145	161583.2	-3322.53	-2147.6	-3987.24
3.125	432787.5	167906	-3408.76	-2061.89	-4061.47
3.28125	449000	174051.6	-3491.27	-1968.82	-4128.89
3.4375	464806.7	180030.5	-3570.44	-1869.46	-4190.15
3.59375	480230.3	185852.4	-3646.62	-1764.74	-4245.83
3.75	495292.3	191526.3	-3720.11	-1655.5	-4296.47
3.90625	510012.4	197060.7	-3791.16	-1542.47	-4342.52
4.0625	524409.1	202463.4	-3860.01	-1426.27	-4384.41
4.21875	538499.7	207741.9	-3926.87	-1307.47	-4422.52
4.375	552300.2	212903	-3991.9	-1186.56	-4457.18
4.53125	565825.5	217952.8	-4055.28	-1063.95	-4488.71
4.6875	579089.6	222897.4	-4117.14	-940.035	-4517.36
4.84375	592105.4	227742.3	-4177.61	-815.134	-4543.4
5	604884.9	232492.4	-4236.8	-689.538	-4567.04

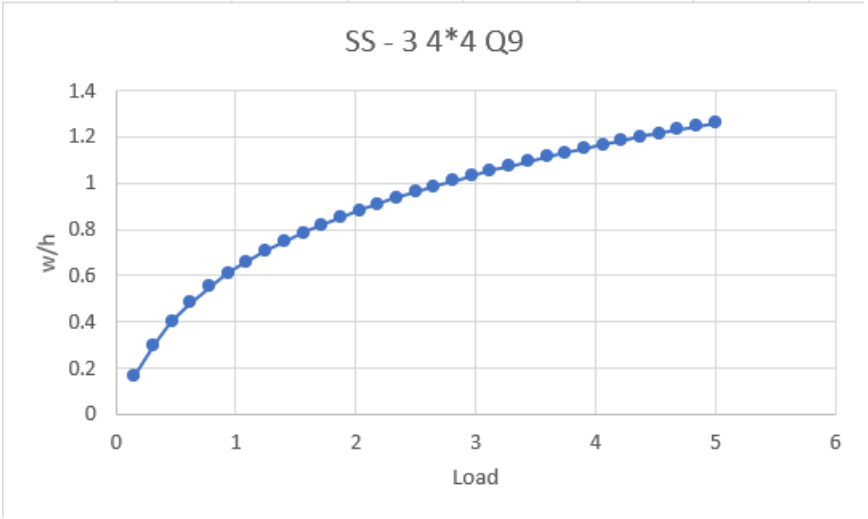
Table 4: Load parameter versus stresses for Clamped 8X8 L4 (at center)

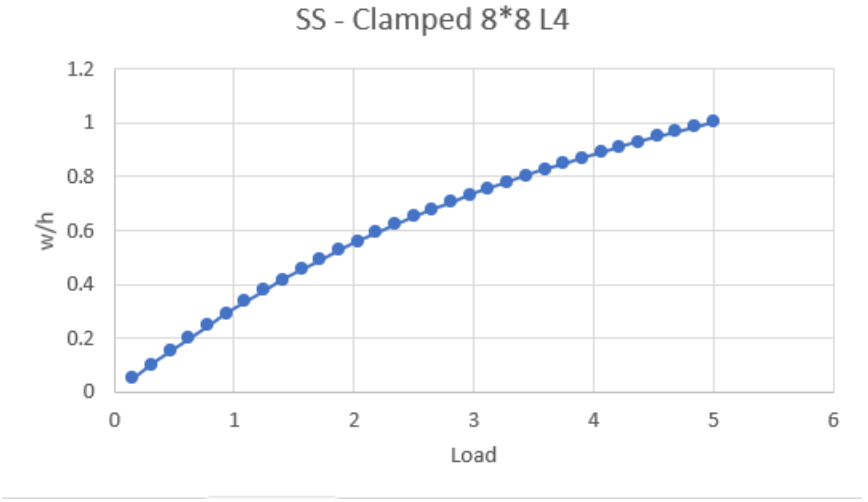
Load Paramete	Clamped 4*4 Q9				
	σ_{xx}	σ_{yy}	σ_{xy}	σ_{yz}	σ_{xz}
0.15625	7126.219	-985.152	-2133.09	-2255.09	-241.127
0.3125	14351.16	-1614.95	-4217.27	-4492.75	-478.984
0.46875	21622.82	-1861.37	-6233.45	-6697.05	-710.59
0.625	28894.52	-1712.82	-8167.31	-8854.62	-933.471
0.78125	36127.46	-1172.86	-10009.7	-10955.3	-1145.78
0.9375	43291.7	-257.147	-11756.2	-12992.1	-1346.28
1.09375	50365.73	1010.269	-13406.3	-14960.9	-1534.32
1.25	57335.35	2600.519	-14962.4	-16860.1	-1709.69
1.40625	64192.2	4482.759	-16428.7	-18689.7	-1872.5
1.5625	70932.29	6626.225	-17810.6	-20451	-2023.12
1.71875	77554.84	9001.549	-19114.1	-22146.2	-2162.06
1.875	84061.23	11581.5	-20345.1	-23777.8	-2289.91
2.03125	90454.26	14341.3	-21509.6	-25348.9	-2407.31
2.1875	96737.61	17258.74	-22613.1	-26862.4	-2514.92
2.34375	102915.5	20314.06	-23660.8	-28321.3	-2613.36
2.5	108992.3	23489.76	-24657.4	-29728.7	-2703.25
2.65625	114972.4	26770.43	-25607.4	-31087.2	-2785.17
2.8125	120860.4	30142.52	-26514.7	-32399.5	-2859.67
2.96875	126660.3	33594.12	-27382.8	-33668.3	-2927.26
3.125	132376.3	37114.75	-28215	-34895.8	-2988.42
3.28125	138012.3	40695.2	-29014.1	-36084.3	-3043.59
3.4375	143571.8	44327.37	-29782.9	-37235.8	-3093.17
3.59375	149058.4	48004.1	-30523.6	-38352.2	-3137.55
3.75	154475.3	51719.09	-31238.4	-39435.4	-3177.07
3.90625	159825.4	55466.76	-31929.3	-40487	-3212.06
4.0625	165111.7	59242.17	-32597.9	-41508.6	-3242.82
4.21875	170336.7	63040.95	-33245.9	-42501.6	-3269.62
4.375	175503	66859.2	-33874.8	-43467.4	-3292.71
4.53125	180612.8	70693.48	-34485.7	-44407.2	-3312.34
4.6875	185668.5	74540.7	-35080	-45322.3	-3328.73
4.84375	190671.9	78398.12	-35658.7	-46213.7	-3342.07
5	195625.1	82263.29	-36222.8	-47082.5	-3352.56

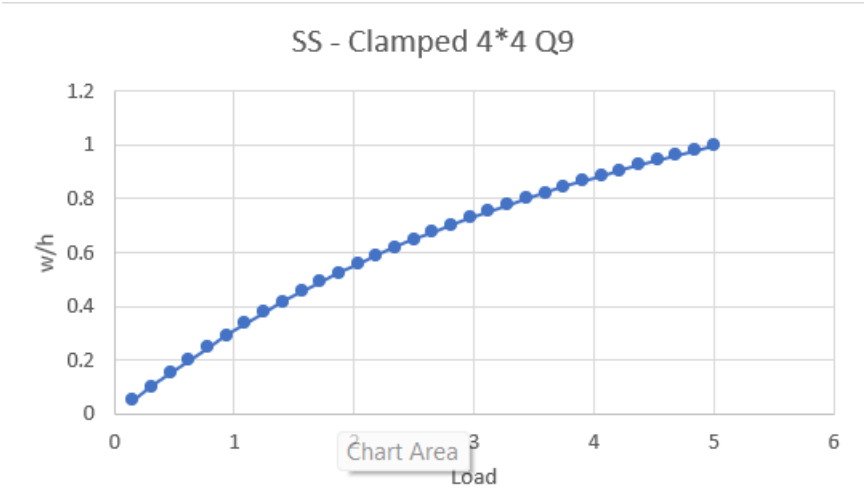
Table 5: Load parameter versus stresses for Clamped 4X4 Q9 (at center)

Deflection Graphs

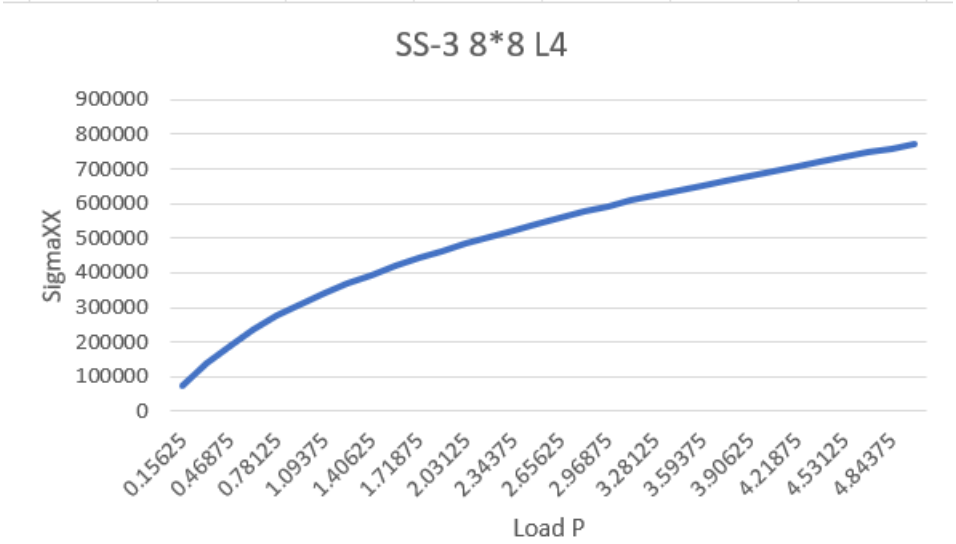


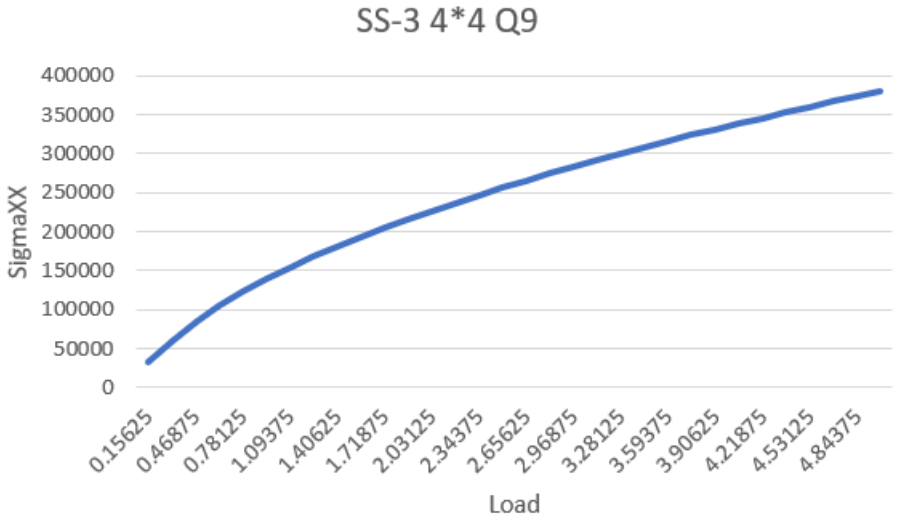


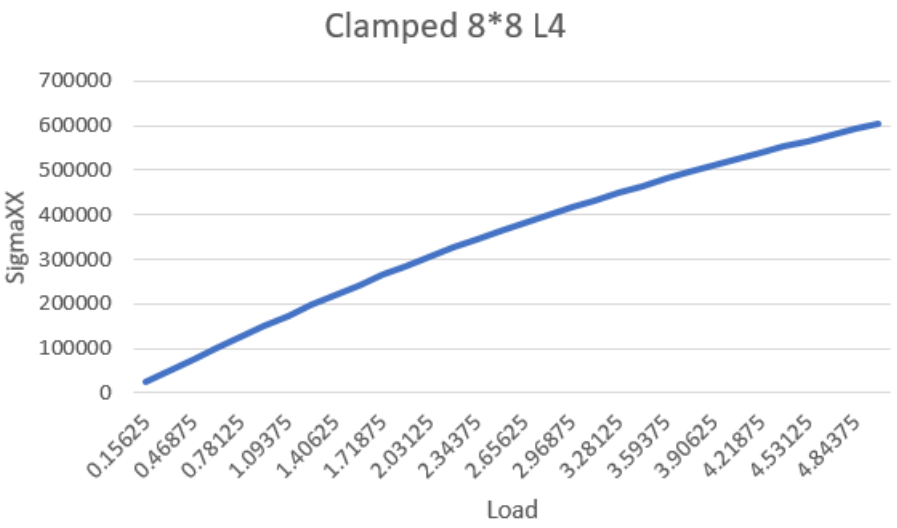


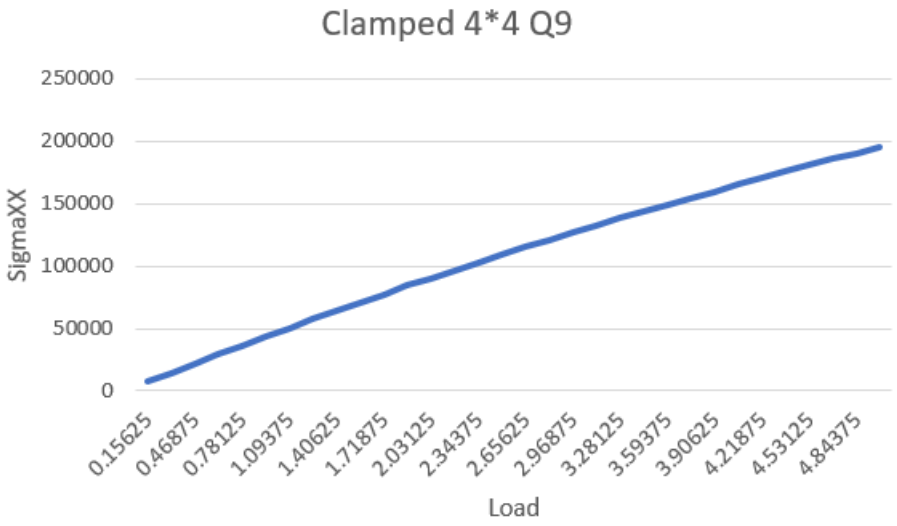


Stress Graphs






Clamped 8*8 L4
700000
600000
500000
400000
300000
200000
100000
0
SigmaXX
0.15625
0.46875
0.78125
1.09375
1.40625
1.71875
2.03125
2.34375
2.65625
2.96875
3.28125
3.59375
3.90625
4.21875
4.53125
4.84375
Load


Clamped 4*4 Q9
250000
200000
150000
100000
50000
0
SigmaXX
0.15625
0.46875
0.78125
1.09375
1.40625
1.71875
2.03125
2.34375
2.65625
2.96875
3.28125
3.59375
3.90625
4.21875
4.53125
4.84375
Load