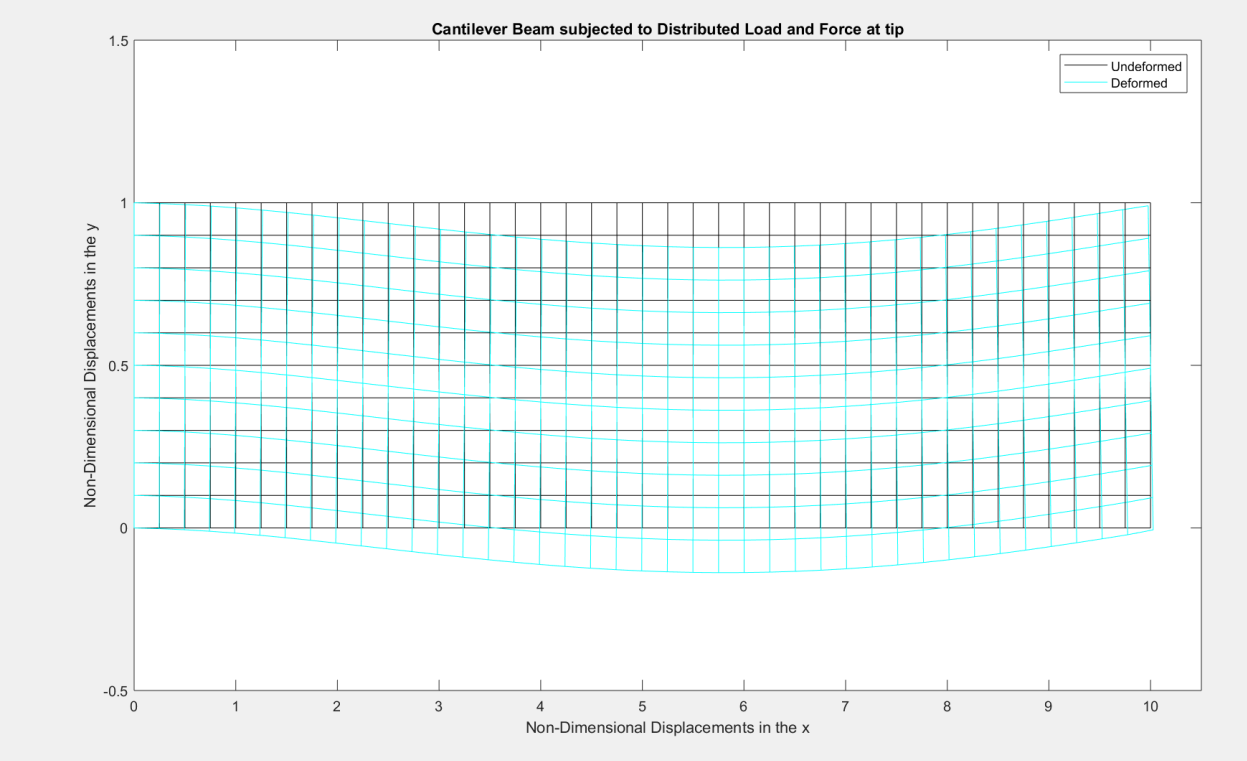
Mesh Generation

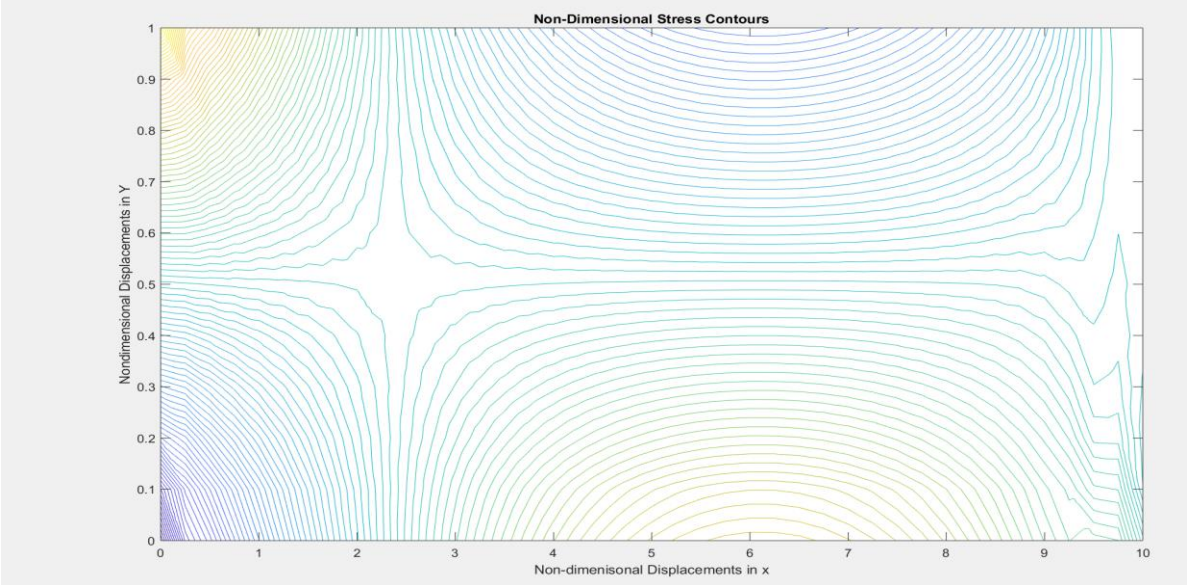
The formulation done in part a allowed one to create a Mesh of N by M elements. The following Mesh was obtained:



From our mesh we can see that the mesh deforms at the center and this is due to the vertical force exerted at the end of the beam.

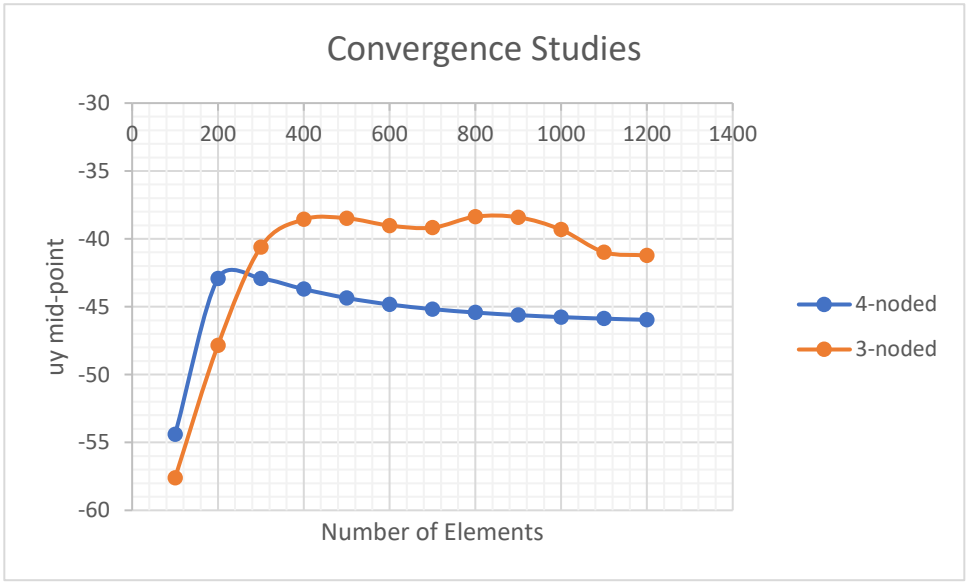
Non-Dimensional Stress Contours

After the mesh was created, the stress contours were then plotted which contain all the three stresses to see the distribution of stresses along the beam. From our graph on the next page we see that the top edge and the bottom edge of the beam are experiencing high stresses, we also observe that the stresses are symmetric and therefore only half of the beam could have been used to do the study. Each node had its own unique value of stress and varied from high low.



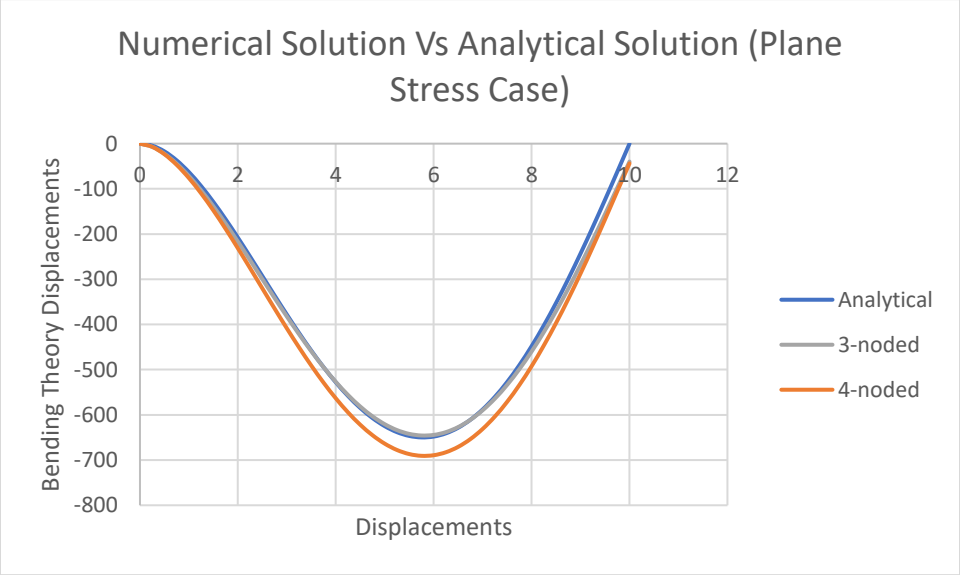
Convergence Studies

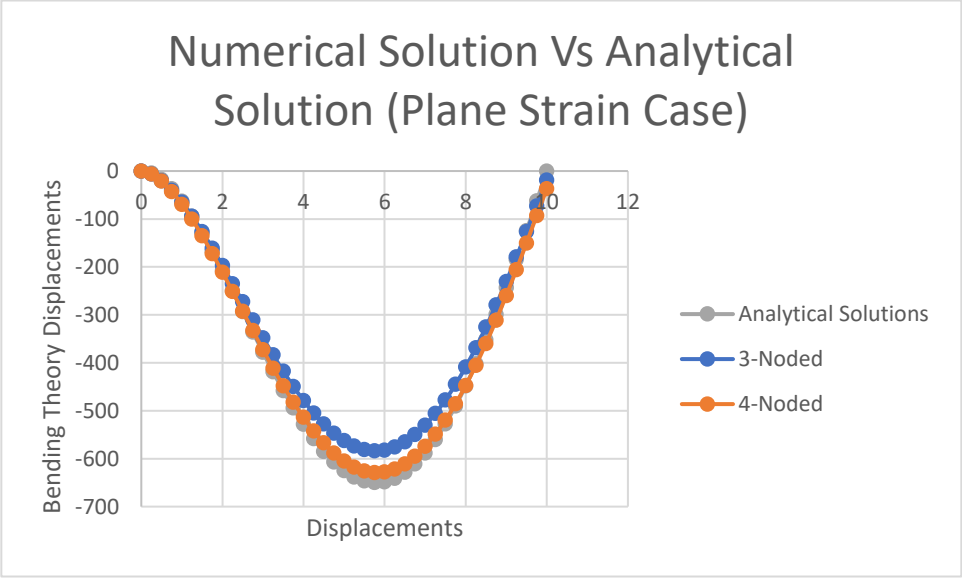
We then created plots for the convergence studies, where the values for n and m were varied to see the number of intervals it takes for the solution to converge. From the graphs we can see that the four noded converges to a value a lot quicker than the 3 noded. More intervals are needed before it converges to a solution.



Numerical Solution Vs Analytical Solution

The displacements plots were then made for the analytical solution, along with the 3-noded and the 4-noded to see the mid-point vertical displacements along the x-axis. One can clearly that the results are for the three cases are quite close. For the Plane Stress case, we notice that the mid-point vertical displacements obtained for the three noded are very close to our analytical solution, however for the plane strain case we notice that the analytical solution is slightly off when compared with the numerical solution.





Results

Please note that this section only contains values for the 50 elements and nodes along with the last 50 fifty element nodes.

4 Noded

Plain Stress case

Elastic matrix D

1.10	0.33	0.00
0.33	1.10	0.00
0.00	0.00	0.38

Displacement Boundary Conditions

node 1 2 3 4 5 6 7 8 9 10 11

ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0 ux=0.0

uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0 uy=0.0

Traction BC

node 11 22 33 44 55 66 77 88 99 110

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.13 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 121 132 143 154 165 176 187 198 209 220

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 231 242 253 264 275 286 297 308 319 330

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 341 352 363 374 385 396 407 418 429 440

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 468

fx=0.0

fy= 0.25

d i s p l a c e m e n t s

.....

****

* * * * * * *

* node * ux * uy ** node * ux * uy *

* * * * * * *

****

*	1 *	0.0000 *	0.0000 **	2 *	0.0000 *	0.0000 *	
*	3 *	0.0000 *	0.0000 **	4 *	0.0000 *	0.0000 *	
*	5 *	0.0000 *	0.0000 **	6 *	0.0000 *	0.0000 *	
*	7 *	0.0000 *	0.0000 **	8 *	0.0000 *	0.0000 *	
*	9 *	0.0000 *	0.0000 **	10 *	0.0000 *	0.0000 *	
*	11 *	0.0000 *	0.0000 **	12 *	-18.1088 *	-11.7137 *	
*	13 *	-12.9548 *	-9.6403 **	14 *	-9.1536 *	-8.3530 *	
*	15 *	-5.8927 *	-7.5897 **	16 *	-2.8918 *	-7.1951 *	
*	17 *	-0.0007 *	-7.0922 **	18 *	2.8924 *	-7.2587 *	
*	19 *	5.8998 *	-7.7205 **	20 *	9.1751 *	-8.5589 *	
*	21 *	13.0085 *	-9.9357 **	22 *	18.2507 *	-12.1221 *	
*	23 *	-32.6494 *	-27.6873 **	24 *	-25.2122 *	-26.2597 *	
*	25 *	-18.2519 *	-25.0346 **	26 *	-11.8547 *	-24.1632 *	
*	27 *	-5.8235 *	-23.6659 **	28 *	0.0343 *	-23.5341 *	
*	29 *	5.8953 *	-23.7632 **	30 *	11.9370 *	-24.3595 *	
*	31 *	18.3528 *	-25.3322 **	32 *	25.3406 *	-26.6591 *	
*	33 *	32.7954 *	-28.1794 **	34 *	-45.4483 *	-50.4999 *	
*	35 *	-35.4501 *	-49.2102 **	36 *	-26.0579 *	-48.2283 *	
*	37 *	-17.0885 *	-47.5213 **	38 *	-8.4255 *	-47.1091 *	
*	39 *	0.0798 *	-47.0051 **	40 *	8.5874 *	-47.2134 *	
*	41 *	17.2568 *	-47.7295 **	42 *	26.2352 *	-48.5386 *	
*	43 *	35.6345 *	-49.6200 **	44 *	45.6369 *	-51.0087 *	
*	45 *	-56.2682 *	-79.0728 **	46 *	-44.1430 *	-78.0119 *	
*	47 *	-32.5809 *	-77.1844 **	48 *	-21.4470 *	-76.6064 *	
*	49 *	-10.5923 *	-76.2779 **	50 *	0.1228 *	-76.2021 *	

*	399 *	67.5907 *	-286.7345 **	400 *	45.3676 *	-287.0159 *	
*	401 *	23.2865 *	-287.1819 **	402 *	1.2865 *	-287.2386 *	
*	403 *	-20.6982 *	-287.1963 **	404 *	-42.7436 *	-287.0636 *	

* 405 *	-64.9346 *	-286.8439 **	406 *	-87.3606 *	-286.5334 *
* 407 *	-110.1104 *	-286.1198 **	408 *	117.1268 *	-227.5266 *
* 409 *	93.4970 *	-227.9197 **	410 *	70.1562 *	-228.2470 *
* 411 *	46.9869 *	-228.4342 **	412 *	23.9968 *	-228.4992 *
* 413 *	1.1519 *	-228.4770 **	414 *	-21.6227 *	-228.3939 *
* 415 *	-44.4257 *	-228.2634 **	416 *	-67.3692 *	-228.0897 *
* 417 *	-90.5757 *	-227.8690 **	418 *	-114.1737 *	-227.5871 *
* 419 *	120.7876 *	-167.0985 **	420 *	96.4385 *	-167.6035 *
* 421 *	71.9864 *	-167.7340 **	422 *	47.9015 *	-167.7066 *
* 423 *	24.2121 *	-167.6457 **	424 *	0.8089 *	-167.5936 *
* 425 *	-22.4493 *	-167.5517 **	426 *	-45.7039 *	-167.5064 *
* 427 *	-69.0897 *	-167.4422 **	428 *	-92.7422 *	-167.3498 *
* 429 *	-116.8231 *	-167.2313 **	430 *	124.8858 *	-105.0429 *
* 431 *	98.1056 *	-104.5309 **	432 *	72.5919 *	-104.3750 *
* 433 *	48.0425 *	-104.5333 **	434 *	24.1088 *	-104.8576 *
* 435 *	0.5234 *	-105.2302 **	436 *	-22.9157 *	-105.5780 *
* 437 *	-46.3665 *	-105.8611 **	438 *	-69.9549 *	-106.0622 *
* 439 *	-93.7795 *	-106.1807 **	440 *	-117.9128 *	-106.2376 *
* 441 *	129.0066 *	-29.5763 **	442 *	99.8884 *	-34.1306 *
* 443 *	73.6755 *	-37.6685 **	444 *	48.8214 *	-40.3377 *
* 445 *	24.6794 *	-42.3039 **	446 *	0.9065 *	-43.7046 *
* 447 *	-22.7134 *	-44.6501 **	448 *	-46.3334 *	-45.2359 *
* 449 *	-70.0639 *	-45.5554 **	450 *	-93.9699 *	-45.7088 *
* 451 *	-118.0355 *	-45.8052 **			

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s t r e s s e s

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element	sx	sy	sxy
1	-56.3409	-0.5499	0.1284
1	-60.2874	-13.7046	-11.3163
1	-73.3670	-17.6285	-13.1580
1	-69.4206	-4.4737	-1.7133
2	-40.4195	-1.9729	-1.7388
2	-42.8698	-10.1405	-10.1797
2	-52.5166	-13.0345	-11.3231
2	-50.0663	-4.8669	-2.8822
3	-26.9466	-2.0642	-2.0331
3	-28.3994	-6.9068	-9.2742
3	-36.6749	-9.3895	-9.9522
3	-35.2221	-4.5468	-2.7111
4	-14.4729	-1.2298	-2.0947
4	-15.2239	-3.7333	-8.7585
4	-22.8397	-6.0180	-9.1090
4	-22.0886	-3.5145	-2.4452
5	-2.4210	0.0854	-2.1747
5	-2.6169	-0.5676	-8.5946
5	-9.9540	-2.7687	-8.6860
5	-9.7581	-2.1157	-2.2661
6	9.5933	1.5644	-2.3375
6	9.9103	2.6211	-8.7617
6	2.5683	0.4185	-8.6137
6	2.2513	-0.6382	-2.1895

*	7	*	21.9391 *	2.9399 *	-2.6047 *	
*	7	*	22.8180 *	5.8696 *	-9.2831 *	
*	7	*	15.1856 *	3.5799 *	-8.8729 *	
*	7	*	14.3067 *	0.6502 *	-2.1946 *	
*	8	*	35.1081 *	3.9203 *	-2.9597 *	
*	8	*	36.7038 *	9.2394 *	-10.2328 *	
*	8	*	28.3917 *	6.7458 *	-9.4881 *	
*	8	*	26.7960 *	1.4266 *	-2.2151 *	
*	9	*	50.0397 *	4.1535 *	-3.2100 *	
*	9	*	52.6603 *	12.8886 *	-11.7223 *	
*	9	*	42.9319 *	9.9701 *	-10.4994 *	
*	9	*	40.3114 *	1.2350 *	-1.9871 *	
*	10	*	69.6688 *	3.6572 *	-2.0369 *	
*	10	*	73.8302 *	17.5287 *	-13.6777 *	
*	10	*	60.5265 *	13.5376 *	-11.7357 *	
*	10	*	56.3651 *	-0.3340 *	-0.0949 *	
*	11	*	-50.8432 *	0.3877 *	1.3905 *	
*	11	*	-49.6140 *	4.4851 *	-3.6797 *	
*	11	*	-55.4086 *	2.7467 *	-3.1061 *	
*	11	*	-56.6378 *	-1.3506 *	1.9641 *	
*	12	*	-38.8447 *	0.7288 *	-1.4409 *	
*	12	*	-38.7262 *	1.1240 *	-8.4561 *	
*	12	*	-46.7434 *	-1.2812 *	-8.4007 *	
*	12	*	-46.8620 *	-1.6763 *	-1.3856 *	
*	13	*	-26.3223 *	0.5890 *	-3.4776 *	
*	13	*	-26.5281 *	-0.0971 *	-10.4419 *	
*	13	*	-34.4873 *	-2.4848 *	-10.5380 *	
*	13	*	-34.2815 *	-1.7988 *	-3.5736 *	
*	14	*	-14.1333 *	0.5163 *	-4.6390 *	

*	14	*	-14.3289 *	-0.1356 *	-11.3680 *
*	14	*	-22.0192 *	-2.4427 *	-11.4593 *
*	14	*	-21.8236 *	-1.7908 *	-4.7303 *
*	15	*	-2.1878 *	0.6003 *	-5.1861 *
*	15	*	-2.2427 *	0.4174 *	-11.7737 *
*	15	*	-9.7714 *	-1.8413 *	-11.7994 *
*	15	*	-9.7165 *	-1.6584 *	-5.2117 *
*	16	*	9.7311 *	0.7604 *	-5.2411 *
*	16	*	9.8502 *	1.1573 *	-11.8318 *
*	16	*	2.3180 *	-1.1024 *	-11.7762 *
*	16	*	2.1989 *	-1.4993 *	-5.1855 *
*	17	*	21.8464 *	0.8756 *	-4.7838 *
*	17	*	22.1024 *	1.7289 *	-11.5214 *
*	17	*	14.4023 *	-0.5811 *	-11.4019 *
*	17	*	14.1463 *	-1.4344 *	-4.6644 *
*	18	*	34.3112 *	0.8505 *	-3.6375 *
*	18	*	34.5668 *	1.7024 *	-10.6115 *
*	18	*	26.5966 *	-0.6887 *	-10.4922 *
*	18	*	26.3410 *	-1.5406 *	-3.5183 *
*	19	*	46.8679 *	0.6858 *	-1.4323 *
*	19	*	46.7729 *	0.3694 *	-8.4369 *
*	19	*	38.7676 *	-2.0322 *	-8.4812 *
*	19	*	38.8625 *	-1.7158 *	-1.4766 *
*	20	*	56.4015 *	0.3098 *	1.9538 *
*	20	*	55.1337 *	-3.9161 *	-2.9594 *
*	20	*	49.5186 *	-5.6007 *	-3.5510 *
*	20	*	50.7864 *	-1.3747 *	1.3622 *
*	21	*	-43.0327 *	0.2785 *	1.1097 *
*	21	*	-42.7702 *	1.1534 *	-4.5774 *

*	21	*	-49.2697 *	-0.7964 *	-4.4549 *
*	21	*	-49.5322 *	-1.6714 *	1.2322 *
*	22	*	-33.1646 *	0.3837 *	-1.4564 *
*	22	*	-32.7018 *	1.9263 *	-6.8564 *
*	22	*	-38.8733 *	0.0749 *	-6.6404 *
*	22	*	-39.3360 *	-1.4677 *	-1.2404 *
*	23	*	-22.9496 *	0.5322 *	-3.4750 *
*	23	*	-22.6366 *	1.5756 *	-9.1870 *
*	23	*	-29.1646 *	-0.3828 *	-9.0409 *
*	23	*	-29.4776 *	-1.4261 *	-3.3290 *
*	24	*	-12.4635 *	0.5635 *	-4.8586 *
*	24	*	-12.3016 *	1.1032 *	-10.7027 *
*	24	*	-18.9805 *	-0.9005 *	-10.6271 *
*	24	*	-19.1424 *	-1.4401 *	-4.7831 *
*	25	*	-1.8970 *	0.5293 *	-5.5394 *
*	25	*	-1.8441 *	0.7056 *	-11.4185 *
*	25	*	-8.5630 *	-1.3101 *	-11.3938 *
*	25	*	-8.6159 *	-1.4864 *	-5.5148 *
*	26	*	8.6736 *	0.4748 *	-5.5137 *
*	26	*	8.6340 *	0.3429 *	-11.3904 *
*	26	*	1.9177 *	-1.6720 *	-11.4089 *
*	26	*	1.9573 *	-1.5401 *	-5.5321 *
*	27	*	19.1859 *	0.4258 *	-4.7718 *
*	27	*	19.0333 *	-0.0830 *	-10.6070 *
*	27	*	12.3644 *	-2.0837 *	-10.6783 *
*	27	*	12.5170 *	-1.5749 *	-4.8430 *
*	28	*	29.4859 *	0.4087 *	-3.3060 *
*	28	*	29.1747 *	-0.6287 *	-8.9962 *
*	28	*	22.6716 *	-2.5796 *	-9.1414 *

*	28	*	22.9828 *	-1.5422 *	-3.4513 *
*	29	*	39.2715 *	0.4486 *	-1.2132 *
*	29	*	38.8042 *	-1.1090 *	-6.5682 *
*	29	*	32.6843 *	-2.9450 *	-6.7863 *
*	29	*	33.1516 *	-1.3873 *	-1.4313 *
*	30	*	49.4097 *	0.6578 *	1.2353 *
*	30	*	49.1592 *	-0.1772 *	-4.4219 *
*	30	*	42.6938 *	-2.1168 *	-4.5388 *
*	30	*	42.9443 *	-1.2818 *	1.1184 *
*	31	*	-36.5297 *	0.1338 *	0.6707 *
*	31	*	-36.0943 *	1.5852 *	-4.0522 *
*	31	*	-41.4918 *	-0.0341 *	-3.8490 *
*	31	*	-41.9272 *	-1.4854 *	0.8739 *
*	32	*	-27.8530 *	0.2447 *	-1.7917 *
*	32	*	-27.5589 *	1.2251 *	-6.6102 *
*	32	*	-33.0658 *	-0.4270 *	-6.4730 *
*	32	*	-33.3599 *	-1.4073 *	-1.6544 *
*	33	*	-19.1736 *	0.3010 *	-3.6409 *
*	33	*	-18.9283 *	1.1187 *	-8.4472 *
*	33	*	-24.4213 *	-0.5291 *	-8.3327 *
*	33	*	-24.6666 *	-1.3469 *	-3.5264 *
*	34	*	-10.4190 *	0.3363 *	-4.8802 *
*	34	*	-10.2596 *	0.8679 *	-9.7472 *
*	34	*	-15.8218 *	-0.8008 *	-9.6727 *
*	34	*	-15.9813 *	-1.3323 *	-4.8058 *
*	35	*	-1.5943 *	0.3386 *	-5.4936 *
*	35	*	-1.5406 *	0.5178 *	-10.4006 *
*	35	*	-7.1487 *	-1.1646 *	-10.3756 *
*	35	*	-7.2024 *	-1.3438 *	-5.4685 *

*	36	*	7.2354 *	0.3226 *	-5.4623 *
*	36	*	7.1786 *	0.1333 *	-10.3661 *
*	36	*	1.5743 *	-1.5480 *	-10.3926 *
*	36	*	1.6311 *	-1.3587 *	-5.4888 *
*	37	*	15.9994 *	0.3127 *	-4.7901 *
*	37	*	15.8369 *	-0.2290 *	-9.6472 *
*	37	*	10.2860 *	-1.8943 *	-9.7231 *
*	37	*	10.4485 *	-1.3526 *	-4.8660 *
*	38	*	24.6609 *	0.3311 *	-3.5063 *
*	38	*	24.4137 *	-0.4929 *	-8.2978 *
*	38	*	18.9378 *	-2.1357 *	-8.4131 *
*	38	*	19.1850 *	-1.3116 *	-3.6217 *
*	39	*	33.3331 *	0.3972 *	-1.6382 *
*	39	*	33.0407 *	-0.5772 *	-6.4446 *
*	39	*	27.5477 *	-2.2251 *	-6.5811 *
*	39	*	27.8400 *	-1.2507 *	-1.7746 *
*	40	*	41.8826 *	0.4787 *	0.8806 *
*	40	*	41.4479 *	-0.9701 *	-3.8323 *
*	40	*	36.0618 *	-2.5859 *	-4.0351 *
*	40	*	36.4964 *	-1.1371 *	0.6777 *
*	41	*	-30.0686 *	0.0163 *	0.3230 *
*	41	*	-29.6891 *	1.2812 *	-3.5595 *
*	41	*	-34.1262 *	-0.0499 *	-3.3824 *
*	41	*	-34.5057 *	-1.3149 *	0.5001 *
*	42	*	-22.9716 *	0.1127 *	-2.0312 *
*	42	*	-22.6651 *	1.1343 *	-5.9660 *
*	42	*	-27.1621 *	-0.2148 *	-5.8230 *
*	42	*	-27.4686 *	-1.2364 *	-1.8882 *
*	43	*	-15.7876 *	0.1670 *	-3.7889 *

*	43	*	-15.5759 *	0.8728 *	-7.7799 *
*	43	*	-20.1370 *	-0.4955 *	-7.6810 *
*	43	*	-20.3487 *	-1.2014 *	-3.6901 *
*	44	*	-8.5629 *	0.1862 *	-4.9514 *
*	44	*	-8.4350 *	0.6125 *	-8.9634 *
*	44	*	-13.0202 *	-0.7631 *	-8.9037 *
*	44	*	-13.1481 *	-1.1894 *	-4.8917 *
*	45	*	-1.3177 *	0.1876 *	-5.5203 *
*	45	*	-1.2757 *	0.3278 *	-9.5447 *
*	45	*	-5.8751 *	-1.0520 *	-9.5251 *
*	45	*	-5.9171 *	-1.1923 *	-5.5006 *
*	46	*	5.9278 *	0.1816 *	-5.4975 *
*	46	*	5.8824 *	0.0302 *	-9.5205 *
*	46	*	1.2846 *	-1.3492 *	-9.5417 *
*	46	*	1.3301 *	-1.1977 *	-5.5187 *
*	47	*	13.1531 *	0.1799 *	-4.8848 *
*	47	*	13.0227 *	-0.2551 *	-8.8931 *
*	47	*	8.4418 *	-1.6293 *	-8.9540 *
*	47	*	8.5723 *	-1.1944 *	-4.9457 *
*	48	*	20.3470 *	0.1943 *	-3.6818 *
*	48	*	20.1339 *	-0.5159 *	-7.6685 *
*	48	*	15.5777 *	-1.8828 *	-7.7679 *
*	48	*	15.7908 *	-1.1725 *	-3.7813 *
*	49	*	27.4601 *	0.2321 *	-1.8810 *
*	49	*	27.1531 *	-0.7913 *	-5.8118 *
*	49	*	22.6608 *	-2.1390 *	-5.9551 *
*	49	*	22.9679 *	-1.1156 *	-2.0243 *
*	50	*	34.4952 *	0.3130 *	0.5031 *
*	50	*	34.1169 *	-0.9483 *	-3.3786 *

*	50	*	29.6807 *	-2.2792 *	-3.5552 *
*	50	*	30.0591 *	-1.0179 *	0.3265 *
*	350	*	-23.9838 *	-1.7791 *	-0.7579 *
*	350	*	-23.8051 *	-1.1834 *	2.0876 *
*	350	*	-20.5532 *	-0.2078 *	2.1710 *
*	350	*	-20.7319 *	-0.8035 *	-0.6745 *
*	351	*	17.7162 *	-0.1412 *	-0.4010 *
*	351	*	17.5403 *	-0.7276 *	1.9891 *
*	351	*	20.2719 *	0.0919 *	1.9070 *
*	351	*	20.4478 *	0.6783 *	-0.4831 *
*	352	*	13.4108 *	-0.1128 *	0.7493 *
*	352	*	13.2397 *	-0.6832 *	3.1454 *
*	352	*	15.9781 *	0.1383 *	3.0656 *
*	352	*	16.1492 *	0.7087 *	0.6695 *
*	353	*	9.1293 *	-0.2213 *	1.6756 *
*	353	*	8.9975 *	-0.6606 *	4.0245 *
*	353	*	11.6819 *	0.1448 *	3.9630 *
*	353	*	11.8136 *	0.5840 *	1.6141 *
*	354	*	4.9015 *	-0.3108 *	2.3060 *
*	354	*	4.7930 *	-0.6725 *	4.6336 *
*	354	*	7.4531 *	0.1255 *	4.5830 *
*	354	*	7.5616 *	0.4872 *	2.2554 *
*	355	*	0.7165 *	-0.4419 *	2.6756 *
*	355	*	0.6355 *	-0.7117 *	4.9701 *
*	355	*	3.2578 *	0.0749 *	4.9323 *
*	355	*	3.3387 *	0.3447 *	2.6379 *
*	356	*	-3.4289 *	-0.6484 *	2.7604 *
*	356	*	-3.4678 *	-0.7781 *	5.0199 *
*	356	*	-0.8855 *	-0.0034 *	5.0017 *

*	356	*	-0.8466 *	0.1263 *	2.7422 *
*	357	*	-7.5580 *	-0.9217 *	2.5169 *
*	357	*	-7.5412 *	-0.8657 *	4.7602 *
*	357	*	-4.9774 *	-0.0966 *	4.7680 *
*	357	*	-4.9942 *	-0.1526 *	2.5248 *
*	358	*	-11.7175 *	-1.2288 *	1.9093 *
*	358	*	-11.6364 *	-0.9586 *	4.1712 *
*	358	*	-9.0514 *	-0.1831 *	4.2090 *
*	358	*	-9.1324 *	-0.4533 *	1.9471 *
*	359	*	-15.9681 *	-1.5220 *	0.9208 *
*	359	*	-15.8214 *	-1.0329 *	3.2448 *
*	359	*	-13.1654 *	-0.2361 *	3.3133 *
*	359	*	-13.3121 *	-0.7252 *	0.9892 *
*	360	*	-20.3747 *	-1.7479 *	-0.4417 *
*	360	*	-20.1688 *	-1.0616 *	1.9897 *
*	360	*	-17.3902 *	-0.2280 *	2.0858 *
*	360	*	-17.5961 *	-0.9143 *	-0.3456 *
*	361	*	14.7143 *	0.2019 *	-0.2953 *
*	361	*	14.4613 *	-0.6415 *	1.7663 *
*	361	*	16.8174 *	0.0654 *	1.6482 *
*	361	*	17.0704 *	0.9088 *	-0.4134 *
*	362	*	10.9889 *	-0.1181 *	0.9197 *
*	362	*	10.8607 *	-0.5455 *	2.9220 *
*	362	*	13.1490 *	0.1410 *	2.8622 *
*	362	*	13.2772 *	0.5684 *	0.8599 *
*	363	*	7.3141 *	0.1231 *	1.7514 *
*	363	*	7.1349 *	-0.4743 *	3.8524 *
*	363	*	9.5361 *	0.2461 *	3.7688 *
*	363	*	9.7154 *	0.8435 *	1.6677 *

*	364	*	3.6817 *		0.2408 *		2.5636 *	
*	364	*	3.4893 *		-0.4004 *		4.5823 *	
*	364	*	5.7964 *		0.2917 *		4.4925 *	
*	364	*	5.9888 *		0.9330 *		2.4738 *	
*	365	*	0.2110 *		0.1182 *		3.1985 *	
*	365	*	0.0609 *		-0.3821 *		5.0746 *	
*	365	*	2.2051 *		0.2612 *		5.0046 *	
*	365	*	2.3552 *		0.7615 *		3.1284 *	
*	366	*	-3.0844 *		-0.1799 *		3.4995 *	
*	366	*	-3.1621 *		-0.4389 *		5.2534 *	
*	366	*	-1.1576 *		0.1625 *		5.2172 *	
*	366	*	-1.0799 *		0.4214 *		3.4632 *	
*	367	*	-6.2584 *		-0.5682 *		3.3746 *	
*	367	*	-6.2541 *		-0.5540 *		5.0568 *	
*	367	*	-4.3316 *		0.0228 *		5.0588 *	
*	367	*	-4.3359 *		0.0086 *		3.3766 *	
*	368	*	-9.3979 *		-0.9849 *		2.7734 *	
*	368	*	-9.3105 *		-0.6937 *		4.4445 *	
*	368	*	-7.4007 *		-0.1207 *		4.4853 *	
*	368	*	-7.4880 *		-0.4119 *		2.8142 *	
*	369	*	-12.6173 *		-1.3885 *		1.6609 *	
*	369	*	-12.4462 *		-0.8183 *		3.3940 *	
*	369	*	-10.4655 *		-0.2240 *		3.4738 *	
*	369	*	-10.6366 *		-0.7943 *		1.7407 *	
*	370	*	-16.0521 *		-1.7188 *		0.0209 *	
*	370	*	-15.8013 *		-0.8829 *		1.9045 *	
*	370	*	-13.6486 *		-0.2371 *		2.0215 *	
*	370	*	-13.8994 *		-1.0730 *		0.1379 *	
*	371	*	12.0110 *		-1.2105 *		-0.2351 *	

*	371	*	12.2240	*	-0.5007	*	1.3621	*						
*	371	*	14.0493	*	0.0469	*	1.4615	*						
*	371	*	13.8364	*	-0.6629	*	-0.1357	*						
*	372	*	8.5098	*	0.8326	*	-0.1105	*						
*	372	*	8.1352	*	-0.4159	*	2.3576	*						
*	372	*	10.9558	*	0.4302	*	2.1828	*						
*	372	*	11.3303	*	1.6788	*	-0.2853	*						
*	373	*	4.8113	*	1.2634	*	1.4674	*						
*	373	*	4.4029	*	-0.0978	*	3.5004	*						
*	373	*	6.7263	*	0.5992	*	3.3098	*						
*	373	*	7.1347	*	1.9605	*	1.2768	*						
*	374	*	1.7091	*	0.8558	*	3.0350	*						
*	374	*	1.4694	*	0.0568	*	4.5878	*						
*	374	*	3.2440	*	0.5892	*	4.4760	*						
*	374	*	3.4837	*	1.3882	*	2.9231	*						
*	375	*	-0.8378	*	0.2067	*	4.0988	*						
*	375	*	-0.8948	*	0.0164	*	5.3383	*						
*	375	*	0.5218	*	0.4414	*	5.3117	*						
*	375	*	0.5789	*	0.6317	*	4.0722	*						
*	376	*	-3.0173	*	-0.3994	*	4.5550	*						
*	376	*	-2.9387	*	-0.1373	*	5.6291	*						
*	376	*	-1.7112	*	0.2310	*	5.6658	*						
*	376	*	-1.7898	*	-0.0311	*	4.5917	*						
*	377	*	-4.9905	*	-0.8642	*	4.4263	*						
*	377	*	-4.8284	*	-0.3239	*	5.4292	*						
*	377	*	-3.6822	*	0.0200	*	5.5049	*						
*	377	*	-3.8443	*	-0.5204	*	4.5019	*						
*	378	*	-6.8639	*	-1.1857	*	3.7535	*						
*	378	*	-6.6553	*	-0.4906	*	4.7356	*						

*	378	*	-5.5330 *	-0.1539 *	4.8329 *
*	378	*	-5.7415 *	-0.8490 *	3.8508 *
*	379	*	-8.7150 *	-1.4197 *	2.5394 *
*	379	*	-8.4708 *	-0.6056 *	3.5299 *
*	379	*	-7.3388 *	-0.2660 *	3.6438 *
*	379	*	-7.5830 *	-1.0801 *	2.6533 *
*	380	*	-10.6924 *	-1.6771 *	0.6820 *
*	380	*	-10.3816 *	-0.6411 *	1.7541 *
*	380	*	-9.1563 *	-0.2735 *	1.8992 *
*	380	*	-9.4671 *	-1.3095 *	0.8271 *
*	381	*	10.5655 *	6.1405 *	-4.3207 *
*	381	*	8.6297 *	-0.3121 *	1.0778 *
*	381	*	14.7995 *	1.5389 *	0.1745 *
*	381	*	16.7353 *	7.9915 *	-5.2241 *
*	382	*	3.9625 *	2.1429 *	0.1156 *
*	382	*	3.4174 *	0.3260 *	2.4727 *
*	382	*	6.1113 *	1.1342 *	2.2183 *
*	382	*	6.6564 *	2.9511 *	-0.1388 *
*	383	*	0.6586 *	-0.9936 *	3.2067 *
*	383	*	1.0121 *	0.1846 *	4.2384 *
*	383	*	2.1911 *	0.5383 *	4.4033 *
*	383	*	1.8377 *	-0.6399 *	3.3717 *
*	384	*	-1.0274 *	-2.7365 *	4.8683 *
*	384	*	-0.2944 *	-0.2930 *	5.4107 *
*	384	*	0.3255 *	-0.1070 *	5.7527 *
*	384	*	-0.4076 *	-2.5505 *	5.2104 *
*	385	*	-2.0183 *	-3.4345 *	5.5167 *
*	385	*	-1.2097 *	-0.7393 *	5.9215 *
*	385	*	-0.7471 *	-0.6005 *	6.2988 *

*	385	*	-1.5557	*	-3.2957	*	5.8941	*
*	386	*	-2.7570	*	-3.4814	*	5.4673	*
*	386	*	-2.0155	*	-1.0095	*	5.8690	*
*	386	*	-1.5564	*	-0.8718	*	6.2150	*
*	386	*	-2.2980	*	-3.3437	*	5.8134	*
*	387	*	-3.4345	*	-3.1672	*	4.9099	*
*	387	*	-2.8095	*	-1.0838	*	5.3455	*
*	387	*	-2.3117	*	-0.9345	*	5.6372	*
*	387	*	-2.9367	*	-3.0179	*	5.2016	*
*	388	*	-4.0932	*	-2.6788	*	3.9569	*
*	388	*	-3.5881	*	-0.9953	*	4.4069	*
*	388	*	-3.0738	*	-0.8410	*	4.6426	*
*	388	*	-3.5788	*	-2.5245	*	4.1926	*
*	389	*	-4.6432	*	-2.1320	*	2.6818	*
*	389	*	-4.2419	*	-0.7944	*	3.0639	*
*	389	*	-3.8053	*	-0.6634	*	3.2511	*
*	389	*	-4.2066	*	-2.0010	*	2.8691	*
*	390	*	-4.8066	*	-1.6403	*	1.1158	*
*	390	*	-4.4726	*	-0.5270	*	1.2322	*
*	390	*	-4.3395	*	-0.4871	*	1.3881	*
*	390	*	-4.6735	*	-1.6004	*	1.2716	*
*	391	*	-1.4763	*	-35.2797	*	-0.1373	*
*	391	*	8.1667	*	-3.1363	*	5.0542	*
*	391	*	14.0999	*	-1.3563	*	9.5543	*
*	391	*	4.4569	*	-33.4997	*	4.3628	*
*	392	*	-3.6774	*	-28.6759	*	3.5758	*
*	392	*	3.3532	*	-5.2406	*	5.1286	*
*	392	*	5.1278	*	-4.7082	*	8.4095	*
*	392	*	-1.9028	*	-28.1436	*	6.8568	*

*	393	*	-3.3436	*	-22.3891	*	4.2338 *
*	393	*	1.4354	*	-6.4590	*	4.9104 *
*	393	*	2.2086	*	-6.2271	*	7.1406 *
*	393	*	-2.5704	*	-22.1571	*	6.4640 *
*	394	*	-2.6367	*	-16.9832	*	4.0858 *
*	394	*	0.4886	*	-6.5655	*	4.5484 *
*	394	*	1.0174	*	-6.4069	*	6.0069 *
*	394	*	-2.1080	*	-16.8246	*	5.5442 *
*	395	*	-2.0435	*	-12.4477	*	3.7073 *
*	395	*	-0.0868	*	-5.9253	*	4.1236 *
*	395	*	0.3889	*	-5.7826	*	5.0367 *
*	395	*	-1.5678	*	-12.3050	*	4.6205 *
*	396	*	-1.6436	*	-8.6848	*	3.2306 *
*	396	*	-0.5059	*	-4.8925	*	3.6321 *
*	396	*	-0.0470	*	-4.7549	*	4.1630 *
*	396	*	-1.1847	*	-8.5472	*	3.7615 *
*	397	*	-1.4178	*	-5.6437	*	2.6595 *
*	397	*	-0.8416	*	-3.7231	*	3.0352 *
*	397	*	-0.4123	*	-3.5942	*	3.3041 *
*	397	*	-0.9885	*	-5.5149	*	2.9284 *
*	398	*	-1.3180	*	-3.3402	*	1.9701 *
*	398	*	-1.0928	*	-2.5895	*	2.2856 *
*	398	*	-0.7322	*	-2.4813	*	2.3907 *
*	398	*	-0.9574	*	-3.2320	*	2.0752 *
*	399	*	-1.2427	*	-1.8333	*	1.1653 *
*	399	*	-1.1762	*	-1.6113	*	1.3460 *
*	399	*	-0.9697	*	-1.5494	*	1.3771 *
*	399	*	-1.0362	*	-1.7713	*	1.1964 *
*	400	*	-0.8926	*	-1.1484	*	0.3707 *

* 400 * -0.8174 * -0.8978 * 0.2204 *

* 400 * -0.9891 * -0.9493 * 0.2555 *

* 400 * -1.0643 * -1.1999 * 0.4058 *

****

3-noded

Plain Strain case

Elastic matrix D

1.35	0.58	0.00
0.58	1.35	0.00
0.00	0.00	0.38

Displacement Boundary Conditions

node	1	2	3	4	5	6	7	8	9	10	11
	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0
	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0

Traction BC

node	11	22	33	44	55	66	77	88	99	110
	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0	fx=0.0
	fy=-0.13	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25	fy=-0.25

node 121 132 143 154 165 176 187 198 209 220

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 231 242 253 264 275 286 297 308 319 330

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 341 352 363 374 385 396 407 418 429 440

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 468

fx=0.0

fy= 0.25

d i s p l a c e m e n t s

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node	ux	uy	node	ux	uy
1	0.0000	0.0000	2	0.0000	0.0000
3	0.0000	0.0000	4	0.0000	0.0000
5	0.0000	0.0000	6	0.0000	0.0000
7	0.0000	0.0000	8	0.0000	0.0000
9	0.0000	0.0000	10	0.0000	0.0000
11	0.0000	0.0000	12	-16.0080	-12.2395
13	-11.1853	-9.5594	14	-7.8332	-7.8403
15	-5.0160	-6.7916	16	-2.4515	-6.2338
17	0.0068	-6.0765	18	2.4667	-6.2934
19	5.0366	-6.9139	20	7.8656	-8.0322
21	11.2440	-9.8334	22	16.1436	-12.6156
23	-29.1703	-26.6113	24	-22.4511	-24.7569
25	-16.1581	-23.1645	26	-10.4478	-22.0225
27	-5.1105	-21.3601	28	0.0508	-21.1707
29	5.2151	-21.4496	30	10.5617	-22.2027
31	16.2888	-23.4370	32	22.6072	-25.1216
33	29.3432	-27.0587	34	-40.7924	-47.2844
35	-31.7562	-45.6074	36	-23.3008	-44.3254
37	-15.2451	-43.3968	38	-7.4910	-42.8475
39	0.1066	-42.6946	40	7.7062	-42.9429
41	15.4665	-43.5869	42	23.5308	-44.6086
43	31.9930	-45.9807	44	41.0330	-47.7472

```
 *  45 *    -50.6502 *    -73.1815 **  46 *    -39.6736 *    -71.8000 *
 *  47 *    -29.2387 *    -70.7211 **  48 *    -19.2162 *    -69.9624 *
 *  49 *     -9.4606 *    -69.5230 **  50 *      0.1606 *    -69.4071 *
* 399 *     62.0872 *   -258.9129 ** 400 *     41.8328 *   -259.2802 *
 * 401 *     21.7151 *   -259.4958 ** 402 *      1.6769 *   -259.5669 *
 * 403 *    -18.3449 *   -259.5042 ** 404 *    -38.4237 *   -259.3165 *
 * 405 *    -58.6418 *   -259.0068 ** 406 *    -79.0852 *   -258.5707 *
 * 407 *    -99.8394 *   -257.9954 ** 408 *    107.2653 *   -204.5035 *
 * 409 *     85.7090 *   -205.0331 ** 410 *     64.4188 *   -205.4554 *
 * 411 *     43.2973 *   -205.7084 ** 412 *     22.3542 *   -205.8130 *
 * 413 *      1.5535 *   -205.8039 ** 414 *    -19.1795 *   -205.7068 *
 * 415 *    -39.9406 *   -205.5354 ** 416 *    -60.8373 *   -205.2938 *
 * 417 *    -81.9865 *   -204.9786 ** 418 *   -103.5100 *   -204.5751 *
 * 419 *    110.6301 *   -149.3383 ** 420 *     88.3679 *   -149.9224 *
 * 421 *     66.0560 *   -150.1382 ** 422 *     44.1139 *   -150.1746 *
 * 423 *     22.5489 *   -150.1471 ** 424 *      1.2513 *   -150.0998 *
 * 425 *    -19.9146 *   -150.0393 ** 426 *    -41.0826 *   -149.9569 *
 * 427 *    -62.3807 *   -149.8410 ** 428 *    -83.9368 *   -149.6847 *
 * 429 *   -105.9040 *   -149.4907 ** 430 *    114.2083 *    -92.6331 *
 * 431 *     89.8260 *    -92.3783 ** 432 *     66.6245 *    -92.3046 *
 * 433 *     44.2960 *    -92.4529 ** 434 *     22.5217 *    -92.7268 *
 * 435 *      1.0588 *    -93.0365 ** 436 *    -20.2778 *    -93.3213 *
 * 437 *    -41.6345 *    -93.5463 ** 438 *    -63.1297 *    -93.6956 *
 * 439 *    -84.8575 *    -93.7691 ** 440 *   -106.8882 *    -93.7895 *
 * 441 *    118.3903 *    -24.0532 ** 442 *     91.9588 *    -28.0862 *
 * 443 *     68.0723 *    -31.2270 ** 444 *     45.3880 *    -33.6188 *
 * 445 *     23.3432 *    -35.3959 ** 446 *      1.6342 *    -36.6701 *
 * 447 *    -19.9340 *    -37.5343 ** 448 *    -41.5011 *    -38.0714 *
 * 449 *    -63.1697 *    -38.3641 ** 450 *    -85.0014 *    -38.5024 *
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* 451 * -106.9852 * -38.5868 **

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s t r e s s e s

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element	sx	sy	sxy
1	-53.5218	0.2900	-0.9492
1	-62.4488	-20.5399	-11.6583
1	-77.4416	-26.9653	-14.0389
1	-68.5145	-6.1355	-3.3298
2	-38.1712	-1.4600	-2.4527
2	-43.8973	-14.8209	-9.8963
2	-54.3184	-19.2871	-11.4233
2	-48.5923	-5.9261	-3.9797
3	-25.4436	-1.8159	-2.2440
3	-28.9365	-9.9661	-8.4998
3	-37.6947	-13.7196	-9.4312
3	-34.2017	-5.5694	-3.1754
4	-13.5803	-0.9855	-1.9926
4	-15.4384	-5.3210	-7.6874
4	-23.4110	-8.7379	-8.1829
4	-21.5530	-4.4024	-2.4881
5	-2.0452	0.4863	-1.9428
5	-2.5690	-0.7358	-7.4016
5	-10.2113	-4.0111	-7.5413

*	5	*	-9.6876 *	-2.7890 *	-2.0824 *
*	6	*	9.4965 *	2.1908 *	-2.1499 *
*	6	*	10.2187 *	3.8759 *	-7.6123 *
*	6	*	2.5714 *	0.5985 *	-7.4197 *
*	6	*	1.8492 *	-1.0866 *	-1.9573 *
*	7	*	21.3725 *	3.7817 *	-2.6395 *
*	7	*	23.4393 *	8.6044 *	-8.3462 *
*	7	*	15.4499 *	5.1804 *	-7.7950 *
*	7	*	13.3830 *	0.3577 *	-2.0883 *
*	8	*	34.0459 *	4.8992 *	-3.4122 *
*	8	*	37.7707 *	13.5905 *	-9.6942 *
*	8	*	28.9759 *	9.8213 *	-8.7009 *
*	8	*	25.2511 *	1.1300 *	-2.4189 *
*	9	*	48.5049 *	5.1772 *	-4.2947 *
*	9	*	54.5045 *	19.1762 *	-11.7967 *
*	9	*	44.0016 *	14.6750 *	-10.1968 *
*	9	*	38.0020 *	0.6759 *	-2.6948 *
*	10	*	68.6925 *	5.3266 *	-3.6419 *
*	10	*	77.9598 *	26.9503 *	-14.5218 *
*	10	*	62.7280 *	20.4224 *	-12.0505 *
*	10	*	53.4607 *	-1.2013 *	-1.1707 *
*	11	*	-51.1144 *	0.3899 *	1.1892 *
*	11	*	-48.3643 *	6.8068 *	-3.0222 *
*	11	*	-54.2602 *	4.2800 *	-2.2888 *
*	11	*	-57.0103 *	-2.1369 *	1.9225 *
*	12	*	-38.8313 *	1.1510 *	-1.7210 *
*	12	*	-38.4092 *	2.1359 *	-8.2515 *
*	12	*	-47.5519 *	-1.7824 *	-8.1389 *
*	12	*	-47.9740 *	-2.7673 *	-1.6084 *

*	13	*	-26.0657 *	1.1613 *	-3.8514 *
*	13	*	-26.3764 *	0.4362 *	-10.2757 *
*	13	*	-35.3705 *	-3.4184 *	-10.3585 *
*	13	*	-35.0597 *	-2.6933 *	-3.9342 *
*	14	*	-13.7789 *	1.1312 *	-5.0309 *
*	14	*	-14.1272 *	0.3184 *	-11.1881 *
*	14	*	-22.7472 *	-3.3759 *	-11.2809 *
*	14	*	-22.3988 *	-2.5631 *	-5.1238 *
*	15	*	-1.7850 *	1.2422 *	-5.5779 *
*	15	*	-1.8923 *	0.9918 *	-11.5802 *
*	15	*	-10.2956 *	-2.6096 *	-11.6089 *
*	15	*	-10.1883 *	-2.3592 *	-5.6065 *
*	16	*	10.1883 *	1.4452 *	-5.6326 *
*	16	*	10.3953 *	1.9282 *	-11.6380 *
*	16	*	1.9878 *	-1.6750 *	-11.5828 *
*	16	*	1.7808 *	-2.1581 *	-5.5774 *
*	17	*	22.4078 *	1.6356 *	-5.1713 *
*	17	*	22.8494 *	2.6658 *	-11.3370 *
*	17	*	14.2173 *	-1.0336 *	-11.2193 *
*	17	*	13.7758 *	-2.0639 *	-5.0535 *
*	18	*	35.0786 *	1.7394 *	-3.9902 *
*	18	*	35.4650 *	2.6411 *	-10.4257 *
*	18	*	26.4552 *	-1.2203 *	-10.3227 *
*	18	*	26.0688 *	-2.1219 *	-3.8871 *
*	19	*	47.9800 *	1.7801 *	-1.6463 *
*	19	*	47.5916 *	0.8737 *	-8.1747 *
*	19	*	38.4518 *	-3.0433 *	-8.2783 *
*	19	*	38.8403 *	-2.1369 *	-1.7499 *
*	20	*	56.7788 *	1.0841 *	1.9200 *

*	20	*	53.9639 *	-5.4841 *	-2.1579 *
*	20	*	48.2549 *	-7.9308 *	-2.9085 *
*	20	*	51.0699 *	-1.3626 *	1.1693 *
*	21	*	-42.8494 *	0.4769 *	0.8514 *
*	21	*	-42.2583 *	1.8559 *	-4.2938 *
*	21	*	-49.4616 *	-1.2312 *	-4.1362 *
*	21	*	-50.0526 *	-2.6102 *	1.0090 *
*	22	*	-33.1469 *	0.6028 *	-1.6913 *
*	22	*	-32.1131 *	3.0152 *	-6.4929 *
*	22	*	-38.8353 *	0.1342 *	-6.2172 *
*	22	*	-39.8692 *	-2.2781 *	-1.4156 *
*	23	*	-22.8834 *	0.8923 *	-3.7370 *
*	23	*	-22.1726 *	2.5508 *	-8.9452 *
*	23	*	-29.4641 *	-0.5741 *	-8.7556 *
*	23	*	-30.1749 *	-2.2326 *	-3.5474 *
*	24	*	-12.2610 *	1.0442 *	-5.1615 *
*	24	*	-11.8843 *	1.9233 *	-10.5283 *
*	24	*	-19.3979 *	-1.2968 *	-10.4279 *
*	24	*	-19.7747 *	-2.1759 *	-5.0610 *
*	25	*	-1.5450 *	1.1035 *	-5.8607 *
*	25	*	-1.4234 *	1.3872 *	-11.2704 *
*	25	*	-8.9971 *	-1.8586 *	-11.2380 *
*	25	*	-9.1187 *	-2.1423 *	-5.8283 *
*	26	*	9.1724 *	1.1309 *	-5.8265 *
*	26	*	9.0704 *	0.8929 *	-11.2344 *
*	26	*	1.4993 *	-2.3519 *	-11.2616 *
*	26	*	1.6013 *	-2.1139 *	-5.8537 *
*	27	*	19.8154 *	1.1619 *	-5.0490 *
*	27	*	19.4521 *	0.3143 *	-10.4087 *

*	27	*	11.9485 *	-2.9016 *	-10.5056 *
*	27	*	12.3118 *	-2.0539 *	-5.1458 *
*	28	*	30.1822 *	1.2147 *	-3.5239 *
*	28	*	29.4739 *	-0.4381 *	-8.7137 *
*	28	*	22.2082 *	-3.5520 *	-8.9026 *
*	28	*	22.9165 *	-1.8992 *	-3.7128 *
*	29	*	39.8018 *	1.2535 *	-1.3881 *
*	29	*	38.7613 *	-1.1745 *	-6.1486 *
*	29	*	32.0966 *	-4.0308 *	-6.4261 *
*	29	*	33.1371 *	-1.6028 *	-1.6656 *
*	30	*	49.9244 *	1.5886 *	1.0127 *
*	30	*	49.3558 *	0.2618 *	-4.1037 *
*	30	*	42.1928 *	-2.8080 *	-4.2553 *
*	30	*	42.7615 *	-1.4812 *	0.8610 *
*	31	*	-36.5099 *	0.2207 *	0.4402 *
*	31	*	-35.5257 *	2.5173 *	-3.8685 *
*	31	*	-41.5579 *	-0.0679 *	-3.6060 *
*	31	*	-42.5422 *	-2.3646 *	0.7027 *
*	32	*	-27.7535 *	0.4338 *	-2.0174 *
*	32	*	-27.0772 *	2.0119 *	-6.4132 *
*	32	*	-33.2314 *	-0.6257 *	-6.2329 *
*	32	*	-33.9077 *	-2.2038 *	-1.8370 *
*	33	*	-19.0367 *	0.5732 *	-3.8655 *
*	33	*	-18.4710 *	1.8933 *	-8.2328 *
*	33	*	-24.5852 *	-0.7271 *	-8.0819 *
*	33	*	-25.1510 *	-2.0472 *	-3.7146 *
*	34	*	-10.2146 *	0.7057 *	-5.1086 *
*	34	*	-9.8484 *	1.5602 *	-9.5530 *
*	34	*	-16.0705 *	-1.1064 *	-9.4553 *

*	34	*	-16.4367 *	-1.9609 *	-5.0110 *
*	35	*	-1.2981 *	0.8031 *	-5.7242 *
*	35	*	-1.1745 *	1.0914 *	-10.2181 *
*	35	*	-7.4659 *	-1.6049 *	-10.1851 *
*	35	*	-7.5895 *	-1.8932 *	-5.6913 *
*	36	*	7.6232 *	0.8741 *	-5.6851 *
*	36	*	7.4940 *	0.5728 *	-10.1760 *
*	36	*	1.2068 *	-2.1217 *	-10.2104 *
*	36	*	1.3360 *	-1.8204 *	-5.7196 *
*	37	*	16.4551 *	0.9421 *	-4.9954 *
*	37	*	16.0835 *	0.0749 *	-9.4307 *
*	37	*	9.8741 *	-2.5863 *	-9.5298 *
*	37	*	10.2457 *	-1.7191 *	-5.0945 *
*	38	*	25.1445 *	1.0305 *	-3.6946 *
*	38	*	24.5753 *	-0.2976 *	-8.0478 *
*	38	*	18.4808 *	-2.9095 *	-8.1996 *
*	38	*	19.0500 *	-1.5814 *	-3.8464 *
*	39	*	33.8794 *	1.1917 *	-1.8208 *
*	39	*	33.2065 *	-0.3785 *	-6.2052 *
*	39	*	27.0683 *	-3.0091 *	-6.3846 *
*	39	*	27.7412 *	-1.4389 *	-2.0002 *
*	40	*	42.4964 *	1.3554 *	0.7093 *
*	40	*	41.5150 *	-0.9347 *	-3.5906 *
*	40	*	35.4952 *	-3.5146 *	-3.8523 *
*	40	*	36.4766 *	-1.2246 *	0.4476 *
*	41	*	-30.0834 *	0.0362 *	0.1269 *
*	41	*	-29.2177 *	2.0561 *	-3.4113 *
*	41	*	-34.1711 *	-0.0668 *	-3.1804 *
*	41	*	-35.0368 *	-2.0867 *	0.3577 *

*	42	*	-22.9204 *	0.2223 *	-2.2249 *
*	42	*	-22.2243 *	1.8466 *	-5.8140 *
*	42	*	-27.2490 *	-0.3069 *	-5.6283 *
*	42	*	-27.9451 *	-1.9311 *	-2.0393 *
*	43	*	-15.6664 *	0.3676 *	-3.9787 *
*	43	*	-15.1838 *	1.4936 *	-7.6237 *
*	43	*	-20.2868 *	-0.6934 *	-7.4950 *
*	43	*	-20.7693 *	-1.8194 *	-3.8500 *
*	44	*	-8.3800 *	0.4725 *	-5.1362 *
*	44	*	-8.0864 *	1.1578 *	-8.7979 *
*	44	*	-13.2128 *	-1.0393 *	-8.7196 *
*	44	*	-13.5065 *	-1.7245 *	-5.0579 *
*	45	*	-1.0743 *	0.5590 *	-5.6994 *
*	45	*	-0.9768 *	0.7866 *	-9.3741 *
*	45	*	-6.1214 *	-1.4182 *	-9.3481 *
*	45	*	-6.2189 *	-1.6458 *	-5.6734 *
*	46	*	6.2306 *	0.6362 *	-5.6702 *
*	46	*	6.1273 *	0.3951 *	-9.3435 *
*	46	*	0.9847 *	-1.8089 *	-9.3711 *
*	46	*	1.0880 *	-1.5678 *	-5.6978 *
*	47	*	13.5119 *	0.7154 *	-5.0511 *
*	47	*	13.2138 *	0.0199 *	-8.7091 *
*	47	*	8.0926 *	-2.1749 *	-8.7885 *
*	47	*	8.3907 *	-1.4794 *	-5.1306 *
*	48	*	20.7674 *	0.8122 *	-3.8418 *
*	48	*	20.2829 *	-0.3184 *	-7.4826 *
*	48	*	15.1858 *	-2.5028 *	-7.6118 *
*	48	*	15.6704 *	-1.3722 *	-3.9710 *
*	49	*	27.9362 *	0.9261 *	-2.0323 *

*	49	*	27.2397 *	-0.6991 *	-5.6174 *
*	49	*	22.2205 *	-2.8502 *	-5.8031 *
*	49	*	22.9171 *	-1.2249 *	-2.2180 *
*	50	*	35.0256 *	1.0840 *	0.3605 *
*	50	*	34.1623 *	-0.9303 *	-3.1766 *
*	50	*	29.2104 *	-3.0525 *	-3.4068 *
*	50	*	30.0736 *	-1.0382 *	0.1303 *
*	350	*	-24.3037 *	-2.2528 *	-0.6420 *
*	350	*	-23.8954 *	-1.3002 *	1.9458 *
*	350	*	-20.2724 *	0.2525 *	2.0547 *
*	350	*	-20.6807 *	-0.7001 *	-0.5332 *
*	351	*	17.6923 *	-0.1939 *	-0.2877 *
*	351	*	17.2803 *	-1.1553 *	1.8948 *
*	351	*	20.3358 *	0.1542 *	1.7849 *
*	351	*	20.7478 *	1.1156 *	-0.3976 *
*	352	*	13.3695 *	-0.2112 *	0.8686 *
*	352	*	13.0007 *	-1.0716 *	3.0480 *
*	352	*	16.0519 *	0.2361 *	2.9497 *
*	352	*	16.4207 *	1.0965 *	0.7703 *
*	353	*	9.0610 *	-0.3500 *	1.7866 *
*	353	*	8.7787 *	-1.0087 *	3.9243 *
*	353	*	11.7715 *	0.2740 *	3.8490 *
*	353	*	12.0538 *	0.9327 *	1.7113 *
*	354	*	4.8124 *	-0.4625 *	2.4135 *
*	354	*	4.5900 *	-0.9814 *	4.5312 *
*	354	*	7.5548 *	0.2892 *	4.4719 *
*	354	*	7.7772 *	0.8082 *	2.3542 *
*	355	*	0.6049 *	-0.6267 *	2.7833 *
*	355	*	0.4542 *	-0.9784 *	4.8658 *

*	355	*	3.3698 *	0.2711 *	4.8256 *	
*	355	*	3.5205 *	0.6228 *	2.7431 *	
*	356	*	-3.5682 *	-0.8770 *	2.8670 *	
*	356	*	-3.6204 *	-0.9989 *	4.9133 *	
*	356	*	-0.7556 *	0.2289 *	4.8993 *	
*	356	*	-0.7033 *	0.3508 *	2.8530 *	
*	357	*	-7.7316 *	-1.2019 *	2.6207 *	
*	357	*	-7.6617 *	-1.0388 *	4.6501 *	
*	357	*	-4.8206 *	0.1788 *	4.6687 *	
*	357	*	-4.8905 *	0.0157 *	2.6393 *	
*	358	*	-11.9319 *	-1.5665 *	2.0097 *	
*	358	*	-11.7254 *	-1.0848 *	4.0563 *	
*	358	*	-8.8602 *	0.1431 *	4.1114 *	
*	358	*	-9.0666 *	-0.3386 *	2.0648 *	
*	359	*	-16.2271 *	-1.9213 *	1.0187 *	
*	359	*	-15.8823 *	-1.1166 *	3.1243 *	
*	359	*	-12.9345 *	0.1467 *	3.2162 *	
*	359	*	-13.2794 *	-0.6580 *	1.1107 *	
*	360	*	-20.6780 *	-2.2113 *	-0.3451 *	
*	360	*	-20.2062 *	-1.1103 *	1.8622 *	
*	360	*	-17.1161 *	0.2140 *	1.9880 *	
*	360	*	-17.5879 *	-0.8870 *	-0.2192 *	
*	361	*	14.7344 *	0.1422 *	-0.1795 *	
*	361	*	14.2284 *	-1.0384 *	1.6853 *	
*	361	*	16.8391 *	0.0804 *	1.5504 *	
*	361	*	17.3451 *	1.2611 *	-0.3144 *	
*	362	*	10.9459 *	-0.1705 *	1.0002 *	
*	362	*	10.6298 *	-0.9079 *	2.8414 *	
*	362	*	13.2075 *	0.1968 *	2.7571 *	

*	362	*	13.5235 *	0.9342 *	0.9159 *
*	363	*	7.2734 *	0.0717 *	1.8490 *
*	363	*	6.8926 *	-0.8169 *	3.7745 *
*	363	*	9.5883 *	0.3384 *	3.6730 *
*	363	*	9.9692 *	1.2271 *	1.7474 *
*	364	*	3.6419 *	0.1537 *	2.6735 *
*	364	*	3.2719 *	-0.7096 *	4.5062 *
*	364	*	5.8377 *	0.3900 *	4.4075 *
*	364	*	6.2077 *	1.2533 *	2.5748 *
*	365	*	0.1578 *	-0.0187 *	3.3032 *
*	365	*	-0.1091 *	-0.6416 *	4.9965 *
*	365	*	2.2616 *	0.3744 *	4.9253 *
*	365	*	2.5285 *	0.9973 *	3.2320 *
*	366	*	-3.1668 *	-0.3702 *	3.5899 *
*	366	*	-3.2815 *	-0.6377 *	5.1693 *
*	366	*	-1.0704 *	0.3099 *	5.1387 *
*	366	*	-0.9557 *	0.5774 *	3.5593 *
*	367	*	-6.3825 *	-0.8138 *	3.4497 *
*	367	*	-6.3283 *	-0.6871 *	4.9646 *
*	367	*	-4.2074 *	0.2218 *	4.9791 *
*	367	*	-4.2617 *	0.0951 *	3.4642 *
*	368	*	-9.5733 *	-1.2902 *	2.8370 *
*	368	*	-9.3464 *	-0.7606 *	4.3442 *
*	368	*	-7.2364 *	0.1437 *	4.4047 *
*	368	*	-7.4634 *	-0.3860 *	2.8976 *
*	369	*	-12.8536 *	-1.7639 *	1.7193 *
*	369	*	-12.4508 *	-0.8241 *	3.2866 *
*	369	*	-10.2566 *	0.1162 *	3.3940 *
*	369	*	-10.6594 *	-0.8235 *	1.8267 *

*	370	*	-16.3520 *	-2.1749 *	0.0836 *
*	370	*	-15.7799 *	-0.8399 *	1.7918 *
*	370	*	-13.3885 *	0.1849 *	1.9444 *
*	370	*	-13.9607 *	-1.1500 *	0.2362 *
*	371	*	11.8169 *	-1.2284 *	-0.2468 *
*	371	*	11.9987 *	-0.8042 *	1.3207 *
*	371	*	14.1932 *	0.1363 *	1.3691 *
*	371	*	14.0114 *	-0.2879 *	-0.1983 *
*	372	*	8.4816 *	0.7841 *	0.0518 *
*	372	*	7.7935 *	-0.8214 *	2.3207 *
*	372	*	10.9700 *	0.5399 *	2.1372 *
*	372	*	11.6580 *	2.1454 *	-0.1317 *
*	373	*	4.8571 *	1.1790 *	1.6404 *
*	373	*	4.1356 *	-0.5045 *	3.4625 *
*	373	*	6.6866 *	0.5888 *	3.2701 *
*	373	*	7.4081 *	2.2723 *	1.4480 *
*	374	*	1.7536 *	0.7470 *	3.1600 *
*	374	*	1.3138 *	-0.2794 *	4.5411 *
*	374	*	3.2473 *	0.5492 *	4.4238 *
*	374	*	3.6872 *	1.5756 *	3.0427 *
*	375	*	-0.8355 *	0.0729 *	4.1761 *
*	375	*	-0.9629 *	-0.2242 *	5.2795 *
*	375	*	0.5819 *	0.4379 *	5.2455 *
*	375	*	0.7092 *	0.7349 *	4.1421 *
*	376	*	-3.0717 *	-0.5666 *	4.5990 *
*	376	*	-2.9498 *	-0.2822 *	5.5602 *
*	376	*	-1.6042 *	0.2944 *	5.5927 *
*	376	*	-1.7261 *	0.0101 *	4.6315 *
*	377	*	-5.1025 *	-1.0747 *	4.4494 *

*	377	*	-4.8059 *	-0.3827 *	5.3532 *
*	377	*	-3.5406 *	0.1596 *	5.4323 *
*	377	*	-3.8371 *	-0.5324 *	4.5285 *
*	378	*	-7.0319 *	-1.4483 *	3.7634 *
*	378	*	-6.6134 *	-0.4717 *	4.6546 *
*	378	*	-5.3657 *	0.0630 *	4.7662 *
*	378	*	-5.7843 *	-0.9136 *	3.8750 *
*	379	*	-8.9426 *	-1.7453 *	2.5420 *
*	379	*	-8.4134 *	-0.5106 *	3.4455 *
*	379	*	-7.1484 *	0.0315 *	3.5866 *
*	379	*	-7.6776 *	-1.2032 *	2.6831 *
*	380	*	-11.0113 *	-2.1008 *	0.6848 *
*	380	*	-10.3134 *	-0.4724 *	1.6702 *
*	380	*	-8.9338 *	0.1189 *	1.8563 *
*	380	*	-9.6317 *	-1.5096 *	0.8709 *
*	381	*	10.7104 *	5.4412 *	-3.7983 *
*	381	*	7.9162 *	-1.0788 *	0.9096 *
*	381	*	14.5072 *	1.7459 *	0.1645 *
*	381	*	17.3015 *	8.2659 *	-4.5434 *
*	382	*	4.1458 *	1.9147 *	0.3673 *
*	382	*	3.1815 *	-0.3354 *	2.3427 *
*	382	*	5.9470 *	0.8499 *	2.0855 *
*	382	*	6.9113 *	3.0999 *	0.1102 *
*	383	*	0.7010 *	-1.0691 *	3.2740 *
*	383	*	1.0737 *	-0.1993 *	4.1322 *
*	383	*	2.2752 *	0.3156 *	4.2316 *
*	383	*	1.9024 *	-0.5542 *	3.3734 *
*	384	*	-1.1211 *	-2.7904 *	4.8599 *
*	384	*	-0.1172 *	-0.4480 *	5.3245 *

*	384	*	0.5333	*	-0.1692	*	5.5922	*	
*	384	*	-0.4706	*	-2.5117	*	5.1276	*	
*	385	*	-2.2000	*	-3.5173	*	5.4904	*	
*	385	*	-1.0108	*	-0.7425	*	5.8574	*	
*	385	*	-0.4969	*	-0.5223	*	6.1745	*	
*	385	*	-1.6861	*	-3.2971	*	5.8075	*	
*	386	*	-2.9840	*	-3.6069	*	5.4457	*	
*	386	*	-1.8337	*	-0.9230	*	5.8249	*	
*	386	*	-1.3028	*	-0.6954	*	6.1316	*	
*	386	*	-2.4531	*	-3.3793	*	5.7524	*	
*	387	*	-3.6801	*	-3.3359	*	4.8978	*	
*	387	*	-2.6563	*	-0.9469	*	5.3165	*	
*	387	*	-2.0701	*	-0.6957	*	5.5895	*	
*	387	*	-3.0940	*	-3.0846	*	5.1709	*	
*	388	*	-4.3466	*	-2.8877	*	3.9502	*	
*	388	*	-3.4632	*	-0.8265	*	4.3879	*	
*	388	*	-2.8504	*	-0.5639	*	4.6234	*	
*	388	*	-3.7338	*	-2.6251	*	4.1857	*	
*	389	*	-4.9060	*	-2.3763	*	2.6696	*	
*	389	*	-4.1404	*	-0.5899	*	3.0510	*	
*	389	*	-3.6064	*	-0.3611	*	3.2552	*	
*	389	*	-4.3720	*	-2.1475	*	2.8737	*	
*	390	*	-5.0834	*	-1.9049	*	1.0820	*	
*	390	*	-4.3693	*	-0.2387	*	1.2229	*	
*	390	*	-4.1721	*	-0.1542	*	1.4133	*	
*	390	*	-4.8862	*	-1.8204	*	1.2725	*	
*	391	*	-4.2234	*	-36.1715	*	0.3109	*	
*	391	*	10.0584	*	-2.8473	*	4.8612	*	
*	391	*	16.4289	*	-0.1171	*	8.6697	*	

*	391	*	2.1471	*	-33.4412	*	4.1193	*	
*	392	*	-5.6256	*	-29.4603	*	3.6961	*	
*	392	*	5.0816	*	-4.4769	*	5.2174	*	
*	392	*	7.2113	*	-3.5642	*	8.0726	*	
*	392	*	-3.4959	*	-28.5476	*	6.5514	*	
*	393	*	-4.7784	*	-23.1213	*	4.2852	*	
*	393	*	2.6945	*	-5.6846	*	5.0751	*	
*	393	*	3.8003	*	-5.2107	*	7.0679	*	
*	393	*	-3.6726	*	-22.6474	*	6.2780	*	
*	394	*	-3.6883	*	-17.6179	*	4.1221	*	
*	394	*	1.3184	*	-5.9355	*	4.7230	*	
*	394	*	2.1597	*	-5.5749	*	6.0582	*	
*	394	*	-2.8470	*	-17.2573	*	5.4572	*	
*	395	*	-2.7971	*	-12.9614	*	3.7350	*	
*	395	*	0.4155	*	-5.4653	*	4.2814	*	
*	395	*	1.1805	*	-5.1375	*	5.1381	*	
*	395	*	-2.0322	*	-12.6336	*	4.5917	*	
*	396	*	-2.1645	*	-9.0790	*	3.2484	*	
*	396	*	-0.2346	*	-4.5760	*	3.7625	*	
*	396	*	0.4852	*	-4.2675	*	4.2772	*	
*	396	*	-1.4447	*	-8.7705	*	3.7630	*	
*	397	*	-1.7606	*	-5.9322	*	2.6681	*	
*	397	*	-0.7209	*	-3.5063	*	3.1355	*	
*	397	*	-0.0666	*	-3.2258	*	3.4128	*	
*	397	*	-1.1062	*	-5.6517	*	2.9454	*	
*	398	*	-1.5320	*	-3.5401	*	1.9722	*	
*	398	*	-1.0544	*	-2.4257	*	2.3573	*	
*	398	*	-0.5154	*	-2.1947	*	2.4846	*	
*	398	*	-0.9930	*	-3.3091	*	2.0996	*	

*	399 *	-1.3755 *	-1.9586 *	1.1629 *
*	399 *	-1.1597 *	-1.4550 *	1.3936 *
*	399 *	-0.8367 *	-1.3166 *	1.4512 *
*	399 *	-1.0525 *	-1.8201 *	1.2205 *
*	400 *	-0.9845 *	-1.2006 *	0.3571 *
*	400 *	-0.7714 *	-0.7034 *	0.2529 *
*	400 *	-0.9173 *	-0.7659 *	0.3097 *
*	400 *	-1.1304 *	-1.2632 *	0.4139 *

****

Connectivity Matrix

1	1	12	13	2
2	2	13	14	3
3	3	14	15	4
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5	5	16	17	6
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399	438	449	450	439
400	439	450	451	440

Coordinate Matrix

1	0.00000	0.00000
2	0.00000	0.10000
3	0.00000	0.20000
4	0.00000	0.30000
5	0.00000	0.40000
6	0.00000	0.50000
7	0.00000	0.60000
8	0.00000	0.70000
9	0.00000	0.80000
10	0.00000	0.90000
11	0.00000	1.00000
12	0.25000	0.00000
13	0.25000	0.10000
14	0.25000	0.20000
15	0.25000	0.30000
16	0.25000	0.40000
17	0.25000	0.50000
18	0.25000	0.60000
19	0.25000	0.70000
20	0.25000	0.80000
21	0.25000	0.90000
22	0.25000	1.00000
23	0.50000	0.00000
24	0.50000	0.10000

25	0.50000	0.20000
26	0.50000	0.30000
27	0.50000	0.40000
28	0.50000	0.50000
29	0.50000	0.60000
30	0.50000	0.70000
31	0.50000	0.80000
32	0.50000	0.90000
33	0.50000	1.00000
34	0.75000	0.00000
35	0.75000	0.10000
36	0.75000	0.20000
37	0.75000	0.30000
38	0.75000	0.40000
39	0.75000	0.50000
40	0.75000	0.60000
41	0.75000	0.70000
42	0.75000	0.80000
43	0.75000	0.90000
44	0.75000	1.00000
45	1.00000	0.00000
46	1.00000	0.10000
47	1.00000	0.20000
48	1.00000	0.30000
49	1.00000	0.40000
50	1.00000	0.50000
51	1.00000	0.60000
52	1.00000	0.70000
53	1.00000	0.80000

54	1.00000	0.90000
55	1.00000	1.00000
56	1.25000	0.00000
57	1.25000	0.10000
58	1.25000	0.20000
59	1.25000	0.30000
60	1.25000	0.40000
61	1.25000	0.50000
62	1.25000	0.60000
63	1.25000	0.70000
64	1.25000	0.80000
65	1.25000	0.90000
66	1.25000	1.00000
67	1.50000	0.00000
68	1.50000	0.10000
69	1.50000	0.20000
70	1.50000	0.30000
71	1.50000	0.40000
72	1.50000	0.50000
73	1.50000	0.60000
74	1.50000	0.70000
75	1.50000	0.80000
76	1.50000	0.90000
77	1.50000	1.00000
78	1.75000	0.00000
79	1.75000	0.10000
80	1.75000	0.20000
81	1.75000	0.30000
82	1.75000	0.40000

83	1.75000	0.50000
84	1.75000	0.60000
85	1.75000	0.70000
86	1.75000	0.80000
87	1.75000	0.90000
88	1.75000	1.00000
89	2.00000	0.00000
90	2.00000	0.10000
91	2.00000	0.20000
92	2.00000	0.30000
93	2.00000	0.40000
94	2.00000	0.50000
95	2.00000	0.60000
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97	2.00000	0.80000
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100	2.25000	0.00000
101	2.25000	0.10000
102	2.25000	0.20000
103	2.25000	0.30000
104	2.25000	0.40000
105	2.25000	0.50000
106	2.25000	0.60000
107	2.25000	0.70000
108	2.25000	0.80000
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111	2.50000	0.00000

112	2.50000	0.10000
113	2.50000	0.20000
114	2.50000	0.30000
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123	2.75000	0.10000
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125	2.75000	0.30000
126	2.75000	0.40000
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137	3.00000	0.40000
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147	3.25000	0.30000
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161	3.50000	0.60000
162	3.50000	0.70000
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165	3.50000	1.00000
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167	3.75000	0.10000
168	3.75000	0.20000
169	3.75000	0.30000

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171	3.75000	0.50000
172	3.75000	0.60000
173	3.75000	0.70000
174	3.75000	0.80000
175	3.75000	0.90000
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178	4.00000	0.10000
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181	4.00000	0.40000
182	4.00000	0.50000
183	4.00000	0.60000
184	4.00000	0.70000
185	4.00000	0.80000
186	4.00000	0.90000
187	4.00000	1.00000
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189	4.25000	0.10000
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191	4.25000	0.30000
192	4.25000	0.40000
193	4.25000	0.50000
194	4.25000	0.60000
195	4.25000	0.70000
196	4.25000	0.80000
197	4.25000	0.90000
198	4.25000	1.00000

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200	4.50000	0.10000
201	4.50000	0.20000
202	4.50000	0.30000
203	4.50000	0.40000
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205	4.50000	0.60000
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207	4.50000	0.80000
208	4.50000	0.90000
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210	4.75000	0.00000
211	4.75000	0.10000
212	4.75000	0.20000
213	4.75000	0.30000
214	4.75000	0.40000
215	4.75000	0.50000
216	4.75000	0.60000
217	4.75000	0.70000
218	4.75000	0.80000
219	4.75000	0.90000
220	4.75000	1.00000
221	5.00000	0.00000
222	5.00000	0.10000
223	5.00000	0.20000
224	5.00000	0.30000
225	5.00000	0.40000
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227	5.00000	0.60000

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252	5.50000	0.90000
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254	5.75000	0.00000
255	5.75000	0.10000
256	5.75000	0.20000

257	5.75000	0.30000
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260	5.75000	0.60000
261	5.75000	0.70000
262	5.75000	0.80000
263	5.75000	0.90000
264	5.75000	1.00000
265	6.00000	0.00000
266	6.00000	0.10000
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270	6.00000	0.50000
271	6.00000	0.60000
272	6.00000	0.70000
273	6.00000	0.80000
274	6.00000	0.90000
275	6.00000	1.00000
276	6.25000	0.00000
277	6.25000	0.10000
278	6.25000	0.20000
279	6.25000	0.30000
280	6.25000	0.40000
281	6.25000	0.50000
282	6.25000	0.60000
283	6.25000	0.70000
284	6.25000	0.80000
285	6.25000	0.90000

286	6.25000	1.00000
287	6.50000	0.00000
288	6.50000	0.10000
289	6.50000	0.20000
290	6.50000	0.30000
291	6.50000	0.40000
292	6.50000	0.50000
293	6.50000	0.60000
294	6.50000	0.70000
295	6.50000	0.80000
296	6.50000	0.90000
297	6.50000	1.00000
298	6.75000	0.00000
299	6.75000	0.10000
300	6.75000	0.20000
301	6.75000	0.30000
302	6.75000	0.40000
303	6.75000	0.50000
304	6.75000	0.60000
305	6.75000	0.70000
306	6.75000	0.80000
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310	7.00000	0.10000
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313	7.00000	0.40000
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392	8.75000	0.60000
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395	8.75000	0.90000
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402	9.00000	0.50000
403	9.00000	0.60000
404	9.00000	0.70000
405	9.00000	0.80000
406	9.00000	0.90000
407	9.00000	1.00000
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411	9.25000	0.30000
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414	9.25000	0.60000
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416	9.25000	0.80000
417	9.25000	0.90000
418	9.25000	1.00000
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420	9.50000	0.10000
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422	9.50000	0.30000
423	9.50000	0.40000
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425	9.50000	0.60000
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431	9.75000	0.10000
432	9.75000	0.20000
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440	9.75000	1.00000
441	10.00000	0.00000
442	10.00000	0.10000
443	10.00000	0.20000
444	10.00000	0.30000
445	10.00000	0.40000
446	10.00000	0.50000
447	10.00000	0.60000
448	10.00000	0.70000
449	10.00000	0.80000
450	10.00000	0.90000
451	10.00000	1.00000

Three Noded

Plain Strain case

Elastic matrix D

1.20	0.40	0.00
0.40	1.20	0.00
0.00	0.00	0.40

d i s p l a c e m e n t s

.....

node	ux	uy	node	ux	uy
1	0.0000	0.0000	2	0.0000	0.0000
3	0.0000	0.0000	4	0.0000	0.0000
5	0.0000	0.0000	6	0.0000	0.0000
7	0.0000	0.0000	8	0.0000	0.0000
9	0.0000	0.0000	10	0.0000	0.0000
11	0.0000	0.0000	12	-15.0175	-10.0776
13	-11.1368	-8.5996	14	-7.9584	-7.5770
15	-5.1601	-6.9181	16	-2.5671	-6.5563
17	-0.0643	-6.4535	18	2.4439	-6.5997
19	5.0611	-7.0145	20	7.9347	-7.7542
21	11.3281	-8.9282	22	15.8035	-10.7355
23	-28.1395	-24.6340	24	-21.6175	-23.2105
25	-15.7164	-22.1367	26	-10.2556	-21.4039
27	-5.0686	-20.9982	28	-0.0055	-20.9104
29	5.0769	-21.1416	30	10.3270	-21.7033
31	15.9067	-22.6132	32	21.9824	-23.8763
33	28.6385	-25.4278	34	-39.4064	-44.8044
35	-30.6812	-43.5803	36	-22.5075	-42.6401

* 37 * -14.7474 * -41.9910 ** 38 * -7.2571 * -41.6360 *

* 39 * 0.1070 * -41.5761 ** 40 * 7.4867 * -41.8115 *

* 41 * 15.0211 * -42.3410 ** 42 * 22.8427 * -43.1584 *

* 43 * 31.0709 * -44.2494 ** 44 * 39.8201 * -45.6019 *

* 45 * -48.9010 * -69.9879 ** 46 * -38.3118 * -68.9716 *

* 47 * -28.2348 * -68.1899 ** 48 * -18.5431 * -67.6509 *

* 49 * -9.1066 * -67.3594 ** 50 * 0.2059 * -67.3178 *

* 399 * 59.9356 * -249.7968 ** 400 * 40.3523 * -250.0532 *

* 401 * 20.9123 * -250.1970 ** 402 * 1.5584 * -250.2386 *

* 403 * -17.7738 * -250.1869 ** 404 * -37.1560 * -250.0468 *

* 405 * -56.6646 * -249.8194 ** 406 * -76.3799 * -249.5012 *

* 407 * -96.3845 * -249.0841 ** 408 * 103.6734 * -197.3887 *

* 409 * 82.7785 * -197.8097 ** 410 * 62.1385 * -198.0976 *

* 411 * 41.7314 * -198.2680 ** 412 * 21.5211 * -198.3470 *

* 413 * 1.4459 * -198.3542 ** 414 * -18.5730 * -198.3009 *

* 415 * -38.6238 * -198.1915 ** 416 * -58.8001 * -198.0256 *

* 417 * -79.2001 * -197.7991 ** 418 * -99.9272 * -197.5046 *

* 419 * 107.0045 * -143.8761 ** 420 * 85.1873 * -144.2369 *

* 421 * 63.6991 * -144.4229 ** 422 * 42.5981 * -144.5347 *

* 423 * 21.8156 * -144.6086 ** 424 * 1.2466 * -144.6543 *

* 425 * -19.2222 * -144.6707 ** 426 * -39.7028 * -144.6523 *

* 427 * -60.3042 * -144.5934 ** 428 * -81.1341 * -144.4899 *

* 429 * -102.3047 * -144.3402 ** 430 * 109.9856 * -88.0036 *

* 431 * 86.7491 * -88.2723 ** 432 * 64.5548 * -88.6391 *

* 433 * 43.0363 * -89.0383 ** 434 * 21.9586 * -89.4253 *

* 435 * 1.1444 * -89.7687 ** 436 * -19.5518 * -90.0481 *

* 437 * -40.2550 * -90.2527 ** 438 * -61.0741 * -90.3805 *

* 439 * -82.1026 * -90.4387 ** 440 * -103.4175 * -90.4446 *

* 441 * 111.4401 * -26.0459 ** 442 * 88.1315 * -28.5240 *

*	443 *	65.7227 *	-30.6674 **	444 *	43.9728 *	-32.4533 *
*	445 *	22.6700 *	-33.8839 **	446 *	1.6405 *	-34.9768 *
*	447 *	-19.2597 *	-35.7616 **	448 *	-40.1505 *	-36.2779 *
*	449 *	-61.1303 *	-36.5767 **	450 *	-82.2719 *	-36.7226 *
*	451 *	-103.6094 *	-36.7966 **			

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s t r e s s e s

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*	element	*	sx	*	sy	*	sxy	*
*	1	*	-72.0840	*	-24.0280	*	-16.1241	*
*	2	*	-47.5449	*	-0.0832	*	1.7633	*
*	3	*	-53.4568	*	-17.8189	*	-13.7593	*
*	4	*	-34.1097	*	-0.4620	*	0.5907	*
*	5	*	-38.2001	*	-12.7334	*	-12.1232	*
*	6	*	-22.1328	*	-0.3493	*	0.1242	*
*	7	*	-24.7684	*	-8.2561	*	-11.0689	*
*	8	*	-10.8750	*	0.2340	*	-0.1181	*
*	9	*	-12.3221	*	-4.1074	*	-10.4901	*

*	10	*	0.1024 *	1.1304 *	-0.3145 *
*	11	*	-0.3087 *	-0.1029 *	-10.3256 *
*	12	*	11.1458 *	2.1561 *	-0.5268 *
*	13	*	11.7305 *	3.9102 *	-10.5595 *
*	14	*	22.6342 *	3.1203 *	-0.7541 *
*	15	*	24.2934 *	8.0978 *	-11.2232 *
*	16	*	35.1280 *	3.8194 *	-0.9122 *
*	17	*	38.0867 *	12.6956 *	-12.4067 *
*	18	*	49.6789 *	4.0367 *	-0.7115 *
*	19	*	54.3750 *	18.1250 *	-14.2851 *
*	20	*	68.6277 *	3.5978 *	0.7248 *
*	21	*	-57.0735 *	-3.2594 *	-7.7676 *
*	22	*	-44.6134 *	0.3125 *	2.7104 *
*	23	*	-46.2168 *	-4.4977 *	-10.6636 *
*	24	*	-32.9433 *	0.4730 *	0.3089 *
*	25	*	-34.6029 *	-4.5060 *	-12.1025 *
*	26	*	-21.5271 *	0.6407 *	-1.3340 *
*	27	*	-23.0111 *	-3.8114 *	-12.8054 *
*	28	*	-10.3841 *	0.8666 *	-2.3591 *
*	29	*	-11.5960 *	-2.7691 *	-13.0958 *
*	30	*	0.6332 *	1.1468 *	-2.8788 *
*	31	*	-0.3023 *	-1.6600 *	-13.0984 *
*	32	*	11.7140 *	1.4387 *	-2.9374 *
*	33	*	10.9796 *	-0.7646 *	-12.7980 *
*	34	*	23.0294 *	1.6849 *	-2.5019 *
*	35	*	22.3175 *	-0.4508 *	-12.0077 *
*	36	*	34.6263 *	1.8373 *	-1.4555 *
*	37	*	33.5694 *	-1.3331 *	-10.2008 *
*	38	*	46.0880 *	1.8895 *	0.3858 *

*	39	*	43.9112 *	-4.6410 *	-6.0153 *
*	40	*	55.4016 *	1.9175 *	3.1167 *
*	41	*	-48.3875 *	-0.9456 *	-6.1848 *
*	42	*	-38.6098 *	0.1863 *	2.3090 *
*	43	*	-39.2106 *	-1.6161 *	-8.9872 *
*	44	*	-28.8360 *	0.4176 *	-0.1103 *
*	45	*	-29.6660 *	-2.0723 *	-10.9620 *
*	46	*	-18.9644 *	0.6022 *	-1.8989 *
*	47	*	-19.9377 *	-2.3179 *	-12.1914 *
*	48	*	-9.0849 *	0.7582 *	-3.0594 *
*	49	*	-10.1539 *	-2.4490 *	-12.7682 *
*	50	*	0.7798 *	0.8991 *	-3.6085 *
*	750	*	-1.1396 *	-0.8679 *	3.6436 *
*	751	*	-0.7434 *	0.3208 *	5.8444 *
*	752	*	-3.1814 *	-1.2346 *	3.9333 *
*	753	*	-2.6785 *	0.2742 *	5.6054 *
*	754	*	-5.1057 *	-1.5058 *	3.7405 *
*	755	*	-4.5155 *	0.2649 *	4.9574 *
*	756	*	-6.9840 *	-1.7002 *	3.0859 *
*	757	*	-6.3134 *	0.3117 *	3.8916 *
*	758	*	-8.8689 *	-1.8516 *	1.9751 *
*	759	*	-8.1053 *	0.4392 *	2.3864 *
*	760	*	-10.8139 *	-2.0086 *	0.3802 *
*	761	*	12.8663 *	0.4405 *	2.1274 *
*	762	*	6.4218 *	-0.7260 *	-3.4026 *
*	763	*	6.7528 *	0.2668 *	3.5904 *
*	764	*	2.6405 *	-3.0321 *	0.4769 *
*	765	*	3.6604 *	0.0274 *	4.8501 *
*	766	*	0.5068 *	-4.0891 *	2.7202 *

*	767	*	1.8079 *	-0.1856 *	5.6645 *
*	768	*	-0.8619 *	-4.4154 *	3.9824 *
*	769	*	0.5031 *	-0.3203 *	6.0171 *
*	770	*	-1.8639 *	-4.2845 *	4.5605 *
*	771	*	-0.5555 *	-0.3593 *	5.9420 *
*	772	*	-2.6994 *	-3.8799 *	4.6114 *
*	773	*	-1.5083 *	-0.3067 *	5.4739 *
*	774	*	-3.4690 *	-3.3384 *	4.2264 *
*	775	*	-2.4153 *	-0.1773 *	4.6338 *
*	776	*	-4.2071 *	-2.7664 *	3.4643 *
*	777	*	-3.2814 *	0.0109 *	3.4210 *
*	778	*	-4.8817 *	-2.2474 *	2.3677 *
*	779	*	-4.0507 *	0.2458 *	1.7992 *
*	780	*	-5.3654 *	-1.8522 *	0.9733 *
*	781	*	5.9069 *	-0.8976 *	6.1863 *
*	782	*	-3.2769 *	-27.5255 *	2.3628 *
*	783	*	5.1685 *	-2.1895 *	6.8201 *
*	784	*	-2.9677 *	-23.8523 *	3.1194 *
*	785	*	4.0092 *	-2.9216 *	6.6805 *
*	786	*	-2.6486 *	-19.9324 *	3.5360 *
*	787	*	2.9469 *	-3.1458 *	6.2249 *
*	788	*	-2.3072 *	-16.0280 *	3.6553 *
*	789	*	2.0411 *	-2.9829 *	5.6097 *
*	790	*	-1.9910 *	-12.3220 *	3.5488 *
*	791	*	1.2634 *	-2.5590 *	4.8822 *
*	792	*	-1.7371 *	-8.9496 *	3.2578 *
*	793	*	0.5836 *	-1.9876 *	4.0454 *
*	794	*	-1.5637 *	-6.0283 *	2.7963 *
*	795	*	-0.0101 *	-1.3674 *	3.0833 *

*	796	*	-1.4655 *	-3.6764 *	2.1668 *
*	797	*	-0.5026 *	-0.7877 *	1.9718 *
*	798	*	-1.3958 *	-2.0210 *	1.3796 *
*	799	*	-0.8363 *	-0.3425 *	0.6861 *
*	800	*	-1.2169 *	-1.1947 *	0.4868 *

****

Plain Stress case

Elastic matrix D

1.07	0.27	0.00
0.27	1.07	0.00
0.00	0.00	0.40

Displacement Boundary Conditions

node	1	2	3	4	5	6	7	8	9	10	11
	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0	ux=0.0
	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0	uy=0.0

Traction BC

node 11 22 33 44 55 66 77 88 99 110

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.13 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 121 132 143 154 165 176 187 198 209 220

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 231 242 253 264 275 286 297 308 319 330

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 341 352 363 374 385 396 407 418 429 440

fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0 fx=0.0

fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25 fy=-0.25

node 242

fx=0.0

fy=-0.25

d i s p l a c e m e n t s

.....

node	ux	uy	node	ux	uy
1	0.0000	0.0000	2	0.0000	0.0000
3	0.0000	0.0000	4	0.0000	0.0000
5	0.0000	0.0000	6	0.0000	0.0000
7	0.0000	0.0000	8	0.0000	0.0000
9	0.0000	0.0000	10	0.0000	0.0000
11	0.0000	0.0000	12	-16.3864	-9.8324
13	-12.2275	-8.6642	14	-8.7647	-7.8718
15	-5.6879	-7.3717	16	-2.8220	-7.1046
17	-0.0495	-7.0371	18	2.7275	-7.1605
19	5.6129	-7.4929	20	8.7490	-8.0842
21	12.3766	-9.0309	22	16.9781	-10.5053
23	-30.3906	-25.2829	24	-23.4122	-24.1533
25	-17.0571	-23.3075	26	-11.1452	-22.7368
27	-5.5107	-22.4280	28	-0.0037	-22.3723

* 29 * 5.5183 * -22.5701 ** 30 * 11.2014 * -23.0317 *

* 31 * 17.2032 * -23.7733 ** 32 * 23.6875 * -24.8030 *

* 33 * 30.7655 * -26.0778 ** 34 * -42.3829 * -46.8065 *

* 35 * -33.0540 * -45.8351 ** 36 * -24.2854 * -45.0921 *

* 37 * -15.9364 * -44.5837 ** 38 * -7.8620 * -44.3122 *

* 39 * 0.0818 * -44.2780 ** 40 * 8.0372 * -44.4816 *

* 41 * 16.1442 * -44.9225 ** 42 * 24.5387 * -45.5969 *

* 43 * 33.3478 * -46.4948 ** 44 * 42.6934 * -47.6059 *

* 45 * -52.4866 * -73.6780 ** 46 * -41.1735 * -72.8716 *

* 47 * -30.3837 * -72.2540 ** 48 * -19.9872 * -71.8321 *

* 49 * -9.8516 * -71.6104 ** 50 * 0.1561 * -71.5910 *

* 399 * 63.2888 * -267.5474 ** 400 * 42.4687 * -267.7483 *

* 401 * 21.7952 * -267.8605 ** 402 * 1.2098 * -267.8939 *

* 403 * -19.3539 * -267.8568 ** 404 * -39.9691 * -267.7541 *

* 405 * -60.7142 * -267.5866 ** 406 * -81.6714 * -267.3511 *

* 407 * -102.9252 * -267.0399 ** 408 * 109.7641 * -212.1333 *

* 409 * 87.5716 * -212.4676 ** 410 * 65.6372 * -212.6902 *

* 411 * 43.9417 * -212.8170 ** 412 * 22.4471 * -212.8722 *

* 413 * 1.0907 * -212.8741 ** 414 * -20.2079 * -212.8332 *

* 415 * -41.5388 * -212.7533 ** 416 * -62.9981 * -212.6336 *

* 417 * -84.6865 * -212.4702 ** 418 * -106.7106 * -212.2558 *

* 419 * 113.3091 * -155.3072 ** 420 * 90.1359 * -155.5966 *

* 421 * 67.3035 * -155.7369 ** 422 * 44.8661 * -155.8215 *

* 423 * 22.7565 * -155.8839 ** 424 * 0.8689 * -155.9319 *

* 425 * -20.9123 * -155.9626 ** 426 * -42.7024 * -155.9692 *

* 427 * -64.6140 * -155.9450 ** 428 * -86.7585 * -155.8849 *

* 429 * -109.2521 * -155.7873 ** 430 * 116.4837 * -95.9473 *

* 431 * 91.7946 * -96.1821 ** 432 * 68.1820 * -96.5411 *

* 433 * 45.2829 * -96.9520 ** 434 * 22.8535 * -97.3623 *

*	435 *	0.7072 *	-97.7350 **	436 *	-21.3093 *	-98.0461 *
*	437 *	-43.3272 *	-98.2826 **	438 *	-65.4602 *	-98.4418 *
*	439 *	-87.8050 *	-98.5302 **	440 *	-110.4406 *	-98.5648 *
*	441 *	117.8681 *	-30.0433 **	442 *	93.0141 *	-32.7269 *
*	443 *	69.1722 *	-35.0429 **	444 *	46.0539 *	-36.9683 *
*	445 *	23.4224 *	-38.5077 **	446 *	1.0871 *	-39.6823 *
*	447 *	-21.1074 *	-40.5255 **	448 *	-43.2896 *	-41.0817 *
*	449 *	-65.5641 *	-41.4069 **	450 *	-88.0073 *	-41.5709 *
*	451 *	-110.6540 *	-41.6606 **			

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s t r e s s e s

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*	element	*	sx	*	sy	*	sxy	*
*	1	*	-69.9154	*	-17.4789	*	-15.7319	*
*	2	*	-49.0553	*	-0.5818	*	2.7731	*
*	3	*	-52.1705	*	-13.0426	*	-13.8628	*
*	4	*	-35.2828	*	-0.8967	*	1.2563	*
*	5	*	-37.3959	*	-9.3490	*	-12.5949	*
*	6	*	-22.9347	*	-0.7327	*	0.5124	*
*	7	*	-24.2683	*	-6.0671	*	-11.7947	*
*	8	*	-11.3284	*	-0.1612	*	0.0960	*
*	9	*	-12.0406	*	-3.0102	*	-11.3674	*
*	10	*	-0.0310	*	0.6679	*	-0.1692	*

*	11	*	-0.2112 *	-0.0528 *	-11.2593 *
*	12	*	11.3079 *	1.5922 *	-0.3490 *
*	13	*	11.6372 *	2.9093 *	-11.4569 *
*	14	*	23.0623 *	2.4421 *	-0.4467 *
*	15	*	23.9485 *	5.9871 *	-11.9886 *
*	16	*	35.7523 *	3.0250 *	-0.3904 *
*	17	*	37.3292 *	9.3323 *	-12.9347 *
*	18	*	50.2823 *	3.1039 *	0.0609 *
*	19	*	52.8068 *	13.2017 *	-14.4494 *
*	20	*	68.5078 *	2.3823 *	1.5973 *
*	21	*	-56.6361 *	-2.4770 *	-8.0849 *
*	22	*	-44.7092 *	0.1185 *	3.1314 *
*	23	*	-45.6083 *	-3.4780 *	-10.9314 *
*	24	*	-33.1254 *	0.1767 *	0.7233 *
*	25	*	-34.0473 *	-3.5108 *	-12.3899 *
*	26	*	-21.7628 *	0.2659 *	-0.9367 *
*	27	*	-22.5723 *	-2.9722 *	-13.1207 *
*	28	*	-10.6480 *	0.4264 *	-1.9793 *
*	29	*	-11.2914 *	-2.1472 *	-13.4273 *
*	30	*	0.3440 *	0.6430 *	-2.5084 *
*	31	*	-0.1338 *	-1.2682 *	-13.4285 *
*	32	*	11.3802 *	0.8670 *	-2.5672 *
*	33	*	11.0214 *	-0.5682 *	-13.1134 *
*	34	*	22.6133 *	1.0377 *	-2.1297 *
*	35	*	22.2673 *	-0.3463 *	-12.3177 *
*	36	*	34.0933 *	1.1070 *	-1.0955 *
*	37	*	33.5466 *	-1.0801 *	-10.5923 *
*	38	*	45.5137 *	1.0809 *	0.7017 *
*	39	*	44.3278 *	-3.6627 *	-6.8296 *

*	40	*	55.4269 *	1.1093 *	3.3961 *
*	41	*	-48.1547 *	-0.7429 *	-6.5239 *
*	42	*	-38.5481 *	0.0773 *	2.6246 *
*	43	*	-38.8831 *	-1.2627 *	-9.2704 *
*	44	*	-28.8596 *	0.2152 *	0.2191 *
*	45	*	-29.3192 *	-1.6232 *	-11.2078 *
*	46	*	-19.0869 *	0.3119 *	-1.5589 *
*	47	*	-19.6189 *	-1.8163 *	-12.4169 *
*	48	*	-9.3084 *	0.3883 *	-2.7172 *
*	49	*	-9.8839 *	-1.9140 *	-12.9867 *
*	50	*	0.4557 *	0.4552 *	-3.2739 *
*	750	*	-1.0745 *	-0.7490 *	3.5569 *
*	751	*	-0.8371 *	0.2003 *	5.9132 *
*	752	*	-3.0874 *	-1.0786 *	3.8681 *
*	753	*	-2.7925 *	0.1011 *	5.6694 *
*	754	*	-4.9826 *	-1.3118 *	3.6940 *
*	755	*	-4.6460 *	0.0346 *	5.0172 *
*	756	*	-6.8301 *	-1.4650 *	3.0555 *
*	757	*	-6.4591 *	0.0193 *	3.9481 *
*	758	*	-8.6804 *	-1.5696 *	1.9586 *
*	759	*	-8.2687 *	0.0772 *	2.4401 *
*	760	*	-10.5836 *	-1.6697 *	0.3751 *
*	761	*	12.7732 *	0.2991 *	2.2833 *
*	762	*	6.4509 *	-0.7351 *	-3.6931 *
*	763	*	6.7028 *	0.2729 *	3.7337 *
*	764	*	2.7908 *	-2.8932 *	0.2631 *
*	765	*	3.5228 *	0.0349 *	4.9637 *
*	766	*	0.6826 *	-3.9378 *	2.5947 *
*	767	*	1.6118 *	-0.2212 *	5.7527 *

*	768	*	-0.6805 *	-4.2734 *	3.9168 *
*	769	*	0.2855 *	-0.4090 *	6.0840 *
*	770	*	-1.6835 *	-4.1481 *	4.5301 *
*	771	*	-0.7714 *	-0.4996 *	5.9902 *
*	772	*	-2.5230 *	-3.7410 *	4.6004 *
*	773	*	-1.7112 *	-0.4939 *	5.5060 *
*	774	*	-3.2966 *	-3.1896 *	4.2267 *
*	775	*	-2.6011 *	-0.4078 *	4.6522 *
*	776	*	-4.0347 *	-2.6007 *	3.4734 *
*	777	*	-3.4500 *	-0.2620 *	3.4272 *
*	778	*	-4.7005 *	-2.0588 *	2.3884 *
*	779	*	-4.2045 *	-0.0750 *	1.7931 *
*	780	*	-5.1632 *	-1.6367 *	1.0134 *
*	781	*	5.2809 *	-1.0276 *	6.6900 *
*	782	*	-1.9528 *	-27.3240 *	2.1123 *
*	783	*	4.2459 *	-2.5294 *	7.0781 *
*	784	*	-1.9512 *	-23.6478 *	3.0296 *
*	785	*	3.1292 *	-3.3262 *	6.8007 *
*	786	*	-1.8448 *	-19.7157 *	3.5008 *
*	787	*	2.1955 *	-3.5544 *	6.2561 *
*	788	*	-1.6777 *	-15.8130 *	3.6410 *
*	789	*	1.4333 *	-3.3688 *	5.5825 *
*	790	*	-1.5116 *	-12.1236 *	3.5433 *
*	791	*	0.7912 *	-2.9124 *	4.8184 *
*	792	*	-1.3871 *	-8.7789 *	3.2551 *
*	793	*	0.2307 *	-2.3077 *	3.9610 *
*	794	*	-1.3225 *	-5.8924 *	2.7926 *
*	795	*	-0.2639 *	-1.6580 *	2.9898 *
*	796	*	-1.3105 *	-3.5795 *	2.1580 *

```
*    797    *    -0.6790 *    -1.0535 *     1.8767 *
*    798    *    -1.3006 *    -1.9656 *     1.3621 *
*    799    *    -0.9554 *    -0.5847 *     0.5921 *
*    800    *    -1.1494 *    -1.1839 *     0.4598 *
************************************************************
C234567
C A FINITE ELEMENT CODE FOR SOLVING PLANE ELASTICITY
C PISS=1 SOLVES PLANE STRAIN PROBLEM
C PISS NON EQUAL TO 1 SOLVES THE PLANE STRESS PROBLEM

C234567
      PROGRAM PROJECT2
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION IELMN(800,3),SLM(6,6),GSM(902,24),KK(6),CORD(451,2),
     *B(3,6),B1(3,6),BT(6,3),D(3,3),IGG(22),F(902),STRAIN(3,1),
     *UEL(6),STRESS(3,1)



C     ELASTIC CONSTANTS EY=YOUNG MODULUS, V=POISSON'S RATIO, D=ELASIC MATRIX

      PISS=11.0
      IF(PISS.EQ.1)GO TO 6
      WRITE(6,99)
      WIDTH=1.0
      GO TO 7
 6    WRITE(6,98)
      WIDTH=1.0
 7    EY=210000
```

```
      V=0.25
      CALL ELASTI (EY,V,PISS,D)
      WRITE(6,100) ((D(I,J),J=1,3),I=1,3)

C     DADA----GEOMETRY OF THE BODY
C     XL------LENGTH OF THE BODY
C     YL------HEIGHT OF THE BODY
C     NGP-----# OF GRID POINTS:::NEL=# OF ELEMENTS
C     IBAND-----BANDWIDTH
C     H-----DISPLACEMENT BOUNDARY LENGTH
C     QP-----APPLIED TRACTION IN THE Y-DIRECTION
C
C
C      PI=DATAN(1.0D0)*4.0D0
C
C
C234567
      XL=10.0
      YL=1.0
      H=YL
      QP=-10.0
      N=40
      M=10

      DX=XL/N
      DY=YL/M
      XII=0.25
      N1=N+1
      M1=M+1
```

```
      M22=M1*2
      NGP=N1*M1
      NGP2=NGP*2
      IBAND=(M1+1)*2
      NEL=M*N*2

C MATRIX DESCRIPTION
C CORD(NGP,2)----COORDINATE'S MATRIX
C IELMN(NEL,3)----ASSOCIATES EACH ELEMENT WITH ITS NODES
C B1=D*B(3,6)
C BT(6,3)----TRANSPOSE OF B1
C SLM(6,6)----ELEMENT STIFFNESS MATRIX IN GLOBAL SENSE
C GSM(NGP2,IBAND)----GLOBAL STIFFNESS MATRIX
C F(NGP2)-----GLOBAL FORCE VECTOR

C234567
      DO 8 I=1,NGP2
      DO 8 J=1,IBAND
 8    GSM(I,J)=0.0
      CALL CRDIXY(M1,N1,NGP,DX,DY,CORD)
      CALL INODES(M,N,M1,NEL,IELMN)

      DO 40 L=1,NEL
      CALL BETA (L,CORD,IELMN,NGP,NEL,DA,B)
      CALL MULT (D,B,B1,3,3,6)
      DO 41 I=1,3
      DO 41 J=1,6
 41   BT(J,I)=B(I,J)
      CALL MULT(BT,B1,SLM,3,6,6)
```

```
      DO 42 IS=1,6
      DO 42 JS=1,6
   42 SLM(IS,JS)=SLM(IS,JS)*DA*WIDTH/2.0
      CALL ASSEMB(IELMN,SLM,NEL,NGP2,IBAND,L,GSM)
   40 CONTINUE

C APPLY GEOMETRIC BCS

      DO 50 I=1,NGP2
   50 F(I)=0.0
      NGP3=NGP-M1
      DO 60 I=M1,NGP3,M1
      F(2*I-1)=F(2*I-1)+0.0
      F(2*I)=F(2*I)+QP*XII/2.0
      F(2*(I+M1)-1)=F(2*(I+M1)-1)+0.0
   60 F(2*(I+M1))=F(2*(I+M1))+QP*XII/2.0
      DO 70 I=1,M1
      SOF=(I-1)*DY+H
      IF(SOF.LT.YL) GO TO 70
      IGG(2*I-1)=2*I-1
      IGG(2*I)=2*I
   70 CONTINUE
      WRITE(6,101)
      WRITE(6,102)(I,I=1,M1)
      WRITE(6,103)
      WRITE(6,104)
      DO 80 KX=1,4
      WRITE(6,105)(((I-1)*M1+11),I=((KX-1)*10+1),KX*10)
   80 WRITE(6,106)(F(((I-1)*M1+11)*2),I=((KX-1)*10+1),KX*10)
```

```
      I=451
      WRITE(6,107) I,F(I*2)

      CALL BOUNDA (M22,NGP2,IBAND,IGG,GSM,F)

C SOLVE FOR NODAL DISPLACEMENTS

      CALL HALLEY (1,GSM,F,NGP2,IBAND)
      CALL HALLEY (2,GSM,F,NGP2,IBAND)
      WRITE(6,111)
      WRITE(6,112)(I,F(2*I-1),F(2*I),I=1,NGP)

C CALCULATION OF THE STRESS FIELD STRESS=STRAIN *D

      WRITE(6,113)
      DO 200 I=1,NEL
      DO 199 J=1,3
      JPN=IELMN(I,J)
      UEL(2*J-1)=F(2*JPN-1)
  199 UEL(2*J)=F(2*JPN)

      CALL BETA (I,CORD,IELMN,NGP,NEL,DA,B)
      CALL MULT (B,UEL,STRAIN,6,3,1)
      CALL MULT (D,STRAIN,STRESS,3,3,1)

      WRITE(6,114)I,(STRESS(IT,1),IT=1,3)
  200 CONTINUE
      WRITE(6,115)
```

```
98   FORMAT(//,10X,'PLAIN STRAIN CASE')

99   FORMAT(//,10X,'PLAIN STRESS CASE')

100  FORMAT(//,10X,'ELASTIC MATRIX D',/(35X,3(F10.2,2X)))

101  FORMAT(5(/),10X,'DISPLACEMENT BOUNDARY CONDITIONS')

102  FORMAT(//,4X,'NODE',11(4X,I2,4X))

103  FORMAT(/,10X,11(2X,'UX=0.0',2X)/10X,11(2X,'UY=0.0',2X))

104  FORMAT(5(/),10X,'TRACTION BC')

105  FORMAT(//,4X,'NODE',10(4X,I3,4X))

106  FORMAT(/,10X,10(2X,'FX=0.0',3X)/10X,10(2X,'FY=',F5.2,1X))

107  FORMAT(//,4X,'NODE',4X,I3,//,12X,'FX=0.0'/12X,'FY=',F5.2)

111  FORMAT(///,47X,'D',2X,'I',2X,'S',2X,'P',2X,'L',2X,'A',2X,'C',
    *2X,'E',2X,'M',2X,'E',2X,'N',2X,'T',2X,'S',/,40X,50('.'),5(/),
    :28X,76('*'),/,28X,2('*',6X,'*',2(14X,'*')),/,28X,2('*',1X,'NODE',
    *1X,'*',6X,'UX',6X,'*',6X,'UY',
    *6X,'*'),/,28X,2('*',6X,'*',2(14X,'*')),/,28X,76('*'))
```

```
 112  FORMAT((28X,2('*',1X,I4,1X,'*',2(1X,F12.8,1X,'*'))))

 113  FORMAT(28X,76('*'),6(/),55X,'S',2X,'T',2X,'R',2X,'E',2X,'S',2X,
     *'S',2X,'E',2X,'S',/,50X,32('.'),5(/),35X,61('*'),/,35X,'*',4(14X,
     *'*'),/,35X,'*',
     *4X,'ELEMENT',3X,'*',6X,'SX',6X,'*',6X,'SY',6X,'*',6X,'SXY',5X,'*',
     */,35X,'*',4(14X,'*'),/,35X,61('*'))

 114  FORMAT((35X,'*',5X,I4,5X,'*',3(1X,F12.4,1X,'*')))
 115  FORMAT(35X,61('*'))

      STOP
      END
C
C*****************************************************
C
      SUBROUTINE CRDIXY(M1,N1,NGP,DX,DY,CORD)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION CORD(NGP,2)
C
      DO 1 I=1,M1
      DO 1 J=1,N1

        JP=(J-1)*M1+I
        CORD(JP,1)=(J-1)*DX
        CORD(JP,2)=(I-1)*DY
 1      CONTINUE
C
```

```
C
      WRITE(6,100)(I,(CORD(I,J),J=1,2),I=1,NGP)
 100  FORMAT("COORDINATE MATRIX",/,((I5,2X,F12.5,F12.5)))
C
C
      RETURN
      END
C
C*****************************************************
C
      SUBROUTINE INODES(M,N,M1,NEL,IELMN)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION IELMN(NEL,3)
C
C
      DO 10 J=1,N
      LP=(J-1)*M1
      KP=LP+1
      DO 10 I=1,M
      KK1=(J-1)*M*2+2*I-1
      KK2=KK1+1
      LP=LP+1
      KP=KP+1
C
C
      IELMN(KK1,1)=LP
      IELMN(KK1,2)=LP+M+1
      IELMN(KK1,3)=LP+1
```

```
      IELMN(KK2,1)=KP
      IELMN(KK2,2)=KP+M
      IELMN(KK2,3)=KP+M+1

   10 CONTINUE

      WRITE(6,200) (I,(IELMN(I,J),J=1,3),I=1,NEL)
  200 FORMAT("CONNECTIVITY MATRIX",/,((I5,2X,I5,2X,I5,2X,I5)))
      RETURN
      END

C
C*************************************************************
C ASSEMBLES THE GLOBAL STIFFNESS MATRIX

      SUBROUTINE ASSEMB(IELMN,SLM,NEL,NGP2,IBAND,L,GSM)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION IELMN(NEL,3),SLM(6,6),GSM(NGP2,IBAND),KK(6)

      DO 10 INODE=1,3
      II=2*INODE
      KK(II)=2*IELMN(L,INODE)
      KK(II-1)=KK(II)-1
   10 CONTINUE

      DO 30 I=1,6
      K=KK(I)
      DO 30 J=1,6
      IF(KK(J).LT.K) GO TO 30
```

```
      LM=KK(J)-K+1
      GSM(K,LM)=GSM(K,LM)+SLM(I,J)
   30 CONTINUE

      RETURN
      END
C
C*************************************************************
C COMPUTES THE B ELEMENT MATRIX

      SUBROUTINE BETA(L,CORD,IELMN,NGP,NEL,DA,B)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION CORD(NGP,2),IELMN(NEL,3),B(3,6),X(3),Y(3)

      DO 3 I=1,3

      MS=IELMN(L,I)

      X(I)=CORD(MS,1)

    3 Y(I)=CORD(MS,2)

      DA=X(1)*Y(2)-X(1)*Y(3)+X(2)*Y(3)-X(2)*Y(1)+X(3)*Y(1)-X(3)*Y(2)

      DO 4 I=1,3

      DO 4 J=1,6

    4 B(I,J)=0.0
```

```
      B(1,1)=(Y(2)-Y(3))/DA

      B(1,3)=(Y(3)-Y(1))/DA


      B(1,5)=(Y(1)-Y(2))/DA

      B(2,2)=(X(3)-X(2))/DA

      B(2,4)=(X(1)-X(3))/DA

      B(2,6)=(X(2)-X(1))/DA

      DO 5 I=1,5,2

 5    B(3,I)=B(2,I+1)

      DO 6 I=2,6,2

 6    B(3,I)=B(1,I-1)

      RETURN
      END
C
C*************************************************************
C MULTIPLICATION OF TWO MATRICES OF THE FORM S(M4,L4)*Q(L4,N4)

      SUBROUTINE MULT(S,Q,C,L4,M4,N4)
```

```
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION S(M4,L4),C(M4,N4),Q(L4,N4)

      DO 10 I=1,M4
      DO 10 J=1,N4
      C(I,J)=0.0
      DO 20 KY=I,L4
   20 C(I,J)=C(I,J)+S(I,KY)*Q(KY,J)
   10 CONTINUE

   90 RETURN
      END
C
C*************************************************************
C COMPUTATION OF ELASTIC MATRIX...D...
      SUBROUTINE ELASTI (EY,V,PISS,D)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION D(3,3)

      IF(PISS.EQ.1) GO TO 1

      DD=EY/(1.0-V**2)

      DOF=V*DD

      D3=EY/(2*(1.0+V))

      GO TO 2
```

```
1    DD=(EY*(1.0-V))/((1.0+V)*(1.0-2.0*V))

     DOF=V*DD/(1.0-V)

     D3=EY/(2.0*(1.0+V))

2    DO 3 I=1,2

     DO 3 J=1,2

     IF(I.EQ.J) GO TO 4

     D(I,J)=DOF

     GO TO 3

4    D(I,J)=DD

3    CONTINUE

     DO 5 I=1,2

     D(I,3)=0.0

5    D(3,I)=0.0

     D(3,3)=D3
     RETURN
     END
```

```
C
C************************************************************
C IMPOSING BC---UNSCRAMBLING THE SYSTEM OF EQNS
C234567
      SUBROUTINE BOUNDA (M22,NGP2,IBAND,IGG,GSM,F)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION IGG(M22),GSM(NGP2,IBAND),F(NGP2)
C
      DO 20 I=1,M22
      KM=IGG(I)
      F(KM)=0.0
      GSM(KM,1)=1.0
C
      DO 20 J=2,IBAND
      KMJ=KM-J+1
      IF(KMJ.LE.0) GO TO 21
      F(KMJ)=F(KMJ)-GSM(KMJ,J)*F(KM)
      GSM(KMJ,J)=0.0
C
 21   KMJ=KM+J-1
      IF(KMJ.GT.NGP2) GO TO 20
      F(KMJ)=F(KMJ)-GSM(KM,J)*F(KM)
      GSM(KM,J)=0.0
 20   CONTINUE
C
      RETURN
      END

C
```

```
C*************************************************************
C234567
      SUBROUTINE HALLEY(KKK,AK,Q,MDIM,NDIM)
      IMPLICIT REAL*8(A-H,O-Z)
C  SYMMETRIC BANDED MATRIX EQUATION SOLVER
C
C  KKK=1 TRIANGULARIZES THE BANDED SYMMETRIC STIFFNESS MATRIX AK(MDIM,NDIM)
C  KKK=2 SOLVES FOR RIGHT HAND SIDE Q(MDIM), SOLUTION RETURNS IN Q(MDIM)
C
      DIMENSION AK(MDIM,NDIM),Q(MDIM)
      NER=MDIM
      IBAND=NDIM
      NRS=NER-1
      NR=NER
      IF (KKK.EQ.2) GO TO 200
      DO 120 N=1,NRS
      M=N-1
      MR=MIN0(IBAND,NR-M)
      PIVOT=AK(N,1)
      DO 120 L=2,MR
      CP=AK(N,L)/PIVOT
      I=M+L
      J=0
      DO 110 K=L,MR
      J=J+1
  110 AK(I,J)=AK(I,J)-CP*AK(N,K)
  120 AK(N,L)=CP
      GO TO 400
  200 DO 220 N=1,NRS
```

```
      M=N-1
      MR=MIN0(IBAND,NR-M)
      CP=Q(N)
      Q(N)=CP/AK(N,1)
      DO 220 L=2,MR
      I=M+L
  220  Q(I)=Q(I)-AK(N,L)*CP
      Q(NR)=Q(NR)/AK(NR,1)
      DO 320 I=1,NRS
      N=NR-I
      M=N-1
      MR=MIN0(IBAND,NR-M)
      DO 320 K=2,MR
      L=M+K
C
C  STORE COMPUTED DISPLACEMENTS IN LOAD VECTOR Q
C234567
  320  Q(N)=Q(N)-AK(N,K)*Q(L)
  400  RETURN
      END
call station (im2,z,w)call station (im2,z,w)call station (im2,z,w)c234567
c A finite element code for solving plane elasticity
c Piss=1 Solves Plane Strain Problem
c Piss Non Equal to 1 solves the plane stress problem

c234567
      program project2
      implicit real*8(a-h,o-z)
      dimension ielmn(400,4),slm(8,8),gsm(902,26),kk(8),cord(451,2)
```

```
      dimension b(3,8),b1(3,8),bt(8,3),d(3,3),igg(22),f(902),strain(3,1)
      dimension uel(8,1),stress(3,1),xq(4),yq(4),dj(2,2)
c     dimension slmsum(8,8)



c     Elastic Constants EY=Young Modulus, v=Poisson's Ratio, D=Elasic Matrix

      piss=11.0
      if(piss.eq.1)go to 6
      write(6,99)
      width=1.0
      go to 7
 6    write(6,98)
      width=1.0
 7    ey=1.0
      v=0.30
      call elasti (ey,v,piss,d)
      write(6,100) ((d(i,j),j=1,3),i=1,3)

c     dada----geometry of the body
c     xl------length of the body
c     yl------height of the body
c     ngp-----# of grid points:::nel=# of elements
c     iband-----bandwidth
c     h-----displacement boundary length
c     qp-----applied traction in the y-direction
c
c
```

```
c      pi=datan(1.0d0)*4.0d0
c
c
c234567
      xl=10.0
      yl=1.0
      h=yl
      qp=-1.0
      n=40
      m=10

      dx=xl/n
      dy=yl/m
      xii=0.25
      n1=n+1
      m1=m+1
      m22=m1*2
      ngp=n1*m1
      ngp2=ngp*2
      iband=(m1+2)*2
      nel=m*n

c Matrix Description
c cord(ngp,2)----coordinate's matrix
c ielmn(nel,3)----associates each element with its nodes
c b1=d*b(3,6)
c bt(6,3)----transpose of b1
c slm(6,6)----element stiffness matrix in global sense
c gsm(ngp2,iband)----global stiffness matrix
```

```
c f(ngp2)-----global force vector


c234567
      do 8 i=1,ngp2
      do 8 j=1,iband
 8    gsm(i,j)=0.0
      call inodes(m,n,m1,nel,ielmn)
      call crdixy(m1,n1,ngp,dx,dy,cord)
      do 40 l=1,nel
c     slmsum(is,js)=0.0d0
      do 40  im=1,4
c     call localuxy(l,ielmn,f,nel,ngp2,ulocal)
      call station (im,z,w)
      call beta(l,cord,ielmn,z,w,ngp,nel,b,da)
      call elasti (ey,v,piss,d)
      call mult(d,b,b1,3,3,8)
      do 41 i=1,3
      do 41 j=1,8
 41   bt(j,i)=b(i,j)
      call mult(bt,b1,slm,3,8,8)
      do 43 is=1,8
      do 43 js=1,8
c     slmsum(is,js)=0.0d0
c     do 42 ls=1,3
c     do 42 ms=1,8
c      do iss=1,8
c      do jss=1,8

 43   slm(is,js)=slm(is,js)*da*width
```

```
c      slmsum(is,js)=0.0d0
c      slmsum(is,js)=slmsum(is,js)+slm(is,js)*da*width
c      call assemb(ielmn,slm,nel,ngp2,iband,l,gsm)
c      enddo
c      enddo
       call assemb(ielmn,slm,nel,ngp2,iband,l,gsm)
 40    continue
c      call assemb(ielmn,slm,nel,ngp2,iband,l,gsm)

c      call  assemb(ielmn,slm,nel,ngp2,iband,l,gsm)
c      write(6,120)z,w,determ
c 120  format(3(f8.3,2x))
c      write(6,121)((B(i,j),j=1,8),i=1,3)
c 121  format(/,8(f8.4,1x))



c



c Apply Geometric BCs

       do 50 i=1,ngp2
 50    f(i)=0.0
       ngp3=ngp-m1
       do 60 i=m1,ngp3,m1
       f(2*i-1)=f(2*i-1)+0.0

       f(2*i)=f(2*i)+qp*xii/2.0
       f(2*(i+m1)-1)=f(2*(i+m1)-1)+0.0
```

```
      f((2*ngp)-(2*m))=-(3*qp*xl)/8
   60 f(2*(i+m1))=f(2*(i+m1))+qp*xii/2.0
      do 70 i=1,m1
      sof=(i-1)*dy+h
      if(sof.lt.yl) go to 70
      igg(2*i-1)=2*i-1
      igg(2*i)=2*i
   70 continue
      write(6,101)
      write(6,102)(i,i=1,m1)
      write(6,103)
      write(6,104)
      do 80 kx=1,4
      write(6,105)(((i-1)*m1+11),i=((kx-1)*10+1),kx*10)
   80 write(6,106)(f(((i-1)*m1+11)*2),i=((kx-1)*10+1),kx*10)
      i=451
      write(6,107) i,f(i*2)

      call bounda (m22,ngp2,iband,igg,gsm,f)

c Solve for nodal displacements

      call halley (1,gsm,f,ngp2,iband)
      call halley (2,gsm,f,ngp2,iband)
      write(6,111)
      write(6,112)(i,f(2*i-1),f(2*i),i=1,ngp)
```

```
c calculation of the stress field stress=strain *d

      write(6,113)
      do 200 i=1,nel
      do 200 im2=1,4
      do 199 j=1,4
      jpn=ielmn(i,j)
      uel(2*j-1,1)=f(2*jpn-1)
 199  uel(2*j,1)=f(2*jpn)
      call station (im2,z,w)
      call beta (i,cord,ielmn,z,w,ngp,nel,b,da)
      call elasti (ey,v,piss,d)
      call mult (b,uel,strain,8,3,1)
      call mult (d,strain,stress,3,3,1)
      write(6,114)i,(stress(it,1),it=1,3)
 200  continue

      write(6,115)
c234567
 98   format(//,10x,'Plain Strain case')

 99   format(//,10x,'Plain Stress case')

 100  format(//,10x,'Elastic matrix D',/(35x,3(f10.2,2x)))

 101  format(5(/),10x,'Displacement Boundary Conditions')

 102  format(//,4x,'node',11(4x,i2,4x))
```

```
103  format(/,10x,11(2x,'ux=0.0',2x)/10x,11(2x,'uy=0.0',2x))

104  format(5(/),10x,'Traction BC')

105  format(//,4x,'node',10(4x,i3,4x))

106  format(/,10x,10(2x,'fx=0.0',3x)/10x,10(2x,'fy=',f5.2,1x))

107  format(//,4x,'node',4x,i3,//,12x,'fx=0.0'/12x,'fy=',f5.2)

111  format(///,47x,'d',2x,'i',2x,'s',2x,'p',2x,'l',2x,'a',2x,'c',
    *2x,'e',2x,'m',2x,'e',2x,'n',2x,'t',2x,'s',/,40x,50('.'),5(/),
    :28x,76('*'),/,28x,2('*',6x,'*',2(14x,'*')),/,28x,2('*',1x,'node',
    *1x,'*',6x,'ux',6x,'*',6x,'uy',
    *6x,'*'),/,28x,2('*',6x,'*',2(14x,'*')),/,28x,76('*'))

112  format((28x,2('*',1x,i4,1x,'*',2(1x,f12.4,1x,'*'))))

113  format(28x,76('*'),6(/),55x,'s',2x,'t',2x,'r',2x,'e',2x,'s',2x,
    *'s',2x,'e',2x,'s',/,50x,32('.'),5(/),35x,61('*'),/,35x,'*',4(14x,
    *'*'),/,35x,'*',
    *4x,'element',3x,'*',6x,'sx',6x,'*',6x,'sy',6x,'*',6x,'sxy',5x,'*',
    */,35x,'*',4(14x,'*'),/,35x,61('*'))
```

```
 114  format((35x,'*',5x,i4,5x,'*',3(1x,f12.4,1x,'*')))
 115  format(35x,61('*'))

      stop
      end
c
c*************************************************
c
      subroutine crdixy(m1,n1,ngp,dx,dy,cord)
      implicit real*8(a-h,o-z)
      dimension cord(ngp,2)
c
      do 1 i=1,m1
      do 1 j=1,n1

      jp=(j-1)*m1+i
      cord(jp,1)=(j-1)*dx
      cord(jp,2)=(i-1)*dy
 1    continue

c     do k=1,n
c     cord(2,1)=cord(2,1)-dx
c     cord(2,2)=-cord(2,1)
c     enddo
c
c
      write(6,100)(i,(cord(i,j),j=1,2),i=1,ngp)
 100  format("Coordinate Matrix",/,((i5,2x,f12.5,f12.5)))
c
```

```
c
      return
      end
c
c*************************************************
c
      subroutine inodes(m,n,m1,nel,ielmn)
      implicit real*8(a-h,o-z)
      dimension ielmn(nel,4)



      do 10  i=1,n
      do 10  j=1,m
      kl=m*(i-1)+j
      kn1=(i-1)*m1+j
      kn2=kn1+m1
      kn3=kn2+1
      kn4=kn1+1

      ielmn(kl,1)=kn1
      ielmn(kl,2)=kn2
      ielmn(kl,3)=kn3
      ielmn(kl,4)=kn4

 10   continue
      write(6,200) (i,(ielmn(i,j),j=1,4),i=1,nel)
 200  format("Connectivity Matrix",/,((i5,2x,i5,2x,i5,2x,i5,2x,i5)))
      return
      end
```

```
c
c************************************************************
c Assembles the global stiffness matrix

      subroutine assemb(ielmn,slm,nel,ngp2,iband,l,gsm)
      implicit real*8(a-h,o-z)
      dimension ielmn(nel,4),slm(8,8),gsm(ngp2,iband),kk(8)

      do 10 inode=1,4
        ii=2*inode
        kk(ii)=2*ielmn(l,inode)
        kk(ii-1)=kk(ii)-1
 10     continue

        do 30 i=1,8
        k=kk(i)
        do 30 j=1,8
        if(kk(j).lt.k) go to 30
        lm=kk(j)-k+1
        gsm(k,lm)=gsm(k,lm)+slm(i,j)
 30     continue

        return
        end
c
c************************************************************
c computes the b element matrix
c234567
```

```
      subroutine beta(l,cord,ielmn,z,w,ngp,nel,b,da)
      implicit real*8(a-h,o-z)
      dimension cord(ngp,2),ielmn(nel,4),b(3,8),xq(4),yq(4),dj(2,2)

      do 1 i=1,4

      ms=ielmn(l,i)

      xq(i)=cord(ms,1)

1     yq(i)=cord(ms,2)

      d11=((w-1.0d0)*(xq(1)-xq(2))+(w+1.0d0)*(xq(3)-xq(4)))/4.0

      d12=((w-1.0d0)*(yq(1)-yq(2))+(w+1.0d0)*(yq(3)-yq(4)))/4.0

      d21=((z-1.0d0)*(xq(1)-xq(4))+(z+1.0d0)*(xq(3)-xq(2)))/4.0

      d22=((z-1.0d0)*(yq(1)-yq(4))+(z+1.0d0)*(yq(3)-yq(2)))/4.0

      da=d11*d22-d12*d21

      dj(1,1)=d22/da
      dj(1,2)=-d12/da
      dj(2,1)=-d21/da
      dj(2,2)=d11/da

      do 2 ks=1,2
```

```
      do 2 kl=1,8
    2 b(ks,kl)=0.0
      b(1,1)=(dj(1,1)*(w-1.0d0)+dj(1,2)*(z-1.0d0))/4.0
      b(2,2)=(dj(2,1)*(w-1.0d0)+dj(2,2)*(z-1.0d0))/4.0
      b(1,3)=-(dj(1,1)*(w-1.0d0)+dj(1,2)*(z+1.0d0))/4.0
      b(2,4)=-(dj(2,1)*(w-1.0d0)+dj(2,2)*(z+1.0d0))/4.0
      b(1,5)=(dj(1,1)*(w+1.0d0)+dj(1,2)*(z+1.0d0))/4.0
      b(2,6)=(dj(2,1)*(w+1.0d0)+dj(2,2)*(z+1.0d0))/4.0
      b(1,7)=-(dj(1,1)*(w+1.0d0)+dj(1,2)*(z-1.0d0))/4.0
      b(2,8)=-(dj(2,1)*(w+1.0d0)+dj(2,2)*(z-1.0d0))/4.0
      do 3 ls=1,7,2
      b(3,ls)=b(2,ls+1)
    3 b(3,ls+1)=b(1,ls)
c     write(6,200)(xq(i),yq(i),i=1,4)
c 200  format(2(f10.3,2x))
c     write(6,201)z,w,determ
c 201  format(3(f8.3,2x))
```

```
      return
      end
c
c
c*************************************************************
c subroutine station chooses the values of z and w to be used
c In Gauss Integration for each integration station
c234567
      subroutine station (ms,z,w)
      implicit real*8(a-h,o-z)
c
      cs1=1.0/sqrt(3.0)
      if (ms-2)1,2,3
 1    z=cs1
      w=z
      go to 5
 2    z=-cs1
      w=-z
      go to 5
 3    if(ms.gt.3) go to 4
      z=-cs1
      w=z
      go to 5
 4    z=cs1
      w=-z
c
 5    return
      end
c*************************************************************
```

```
c Multiplication of two matrices of the form s(m4,l4)*q(l4,n4)

      subroutine mult(s,q,c,l4,m4,n4)
      implicit real*8(a-h,o-z)
      dimension s(m4,l4),c(m4,n4),q(l4,n4)

      do 10 i=1,m4
      do 10 j=1,n4
      c(i,j)=0.0
      do 20 ky=1,l4
   20 c(i,j)=c(i,j)+s(i,ky)*q(ky,j)
   10 continue

   90 return
      end
c
c*************************************************************
c computation of elastic matrix...d...
      subroutine elasti (ey,v,piss,d)
      implicit real*8(a-h,o-z)
      dimension d(3,3)

      if(piss.eq.1) go to 1

      dd=ey/(1.0-v**2)

      dof=v*dd

      d3=ey/(2*(1.0+v))
```

```
      go to 2
1     dd=(ey*(1.0-v))/((1.0+v)*(1.0-2.0*v))
      dof=v*dd/(1.0-v)
      d3=ey/(2.0*(1.0+v))
2     do 3 i=1,2
      do 3 j=1,2
      if(i.eq.j) go to 4
      d(i,j)=dof
      go to 3
4     d(i,j)=dd
3     continue
      do 5 i=1,2
      d(i,3)=0.0
5     d(3,i)=0.0
```

```
      d(3,3)=d3
      return
      end
c
c*************************************************************
c Imposing BC---Unscrambling the system of eqns
c234567
      subroutine bounda (m22,ngp2,iband,igg,gsm,f)
      implicit real*8(a-h,o-z)
      dimension igg(m22),gsm(ngp2,iband),f(ngp2)
c
      do 20 i=1,m22
      km=igg(i)
      f(km)=0.0
      gsm(km,1)=1.0
c
      do 20 j=2,iband
      kmj=km-j+1
      if(kmj.le.0) go to 21
      f(kmj)=f(kmj)-gsm(kmj,j)*f(km)
      gsm(kmj,j)=0.0
c
 21   kmj=km+j-1
      if(kmj.gt.ngp2) go to 20
      f(kmj)=f(kmj)-gsm(km,j)*f(km)
      gsm(km,j)=0.0
 20   continue
c
      return
```

```
      end


c
c*************************************************************
c234567
      subroutine halley(kkk,ak,q,mdim,ndim)
      implicit real*8(a-h,o-z)
c  symmetric banded matrix equation solver
c
c  kkk=1 triangularizes the banded symmetric stiffness matrix ak(mdim,ndim)
c  kkk=2 solves for right hand side q(mdim), solution returns in q(mdim)
c
      dimension ak(mdim,ndim),q(mdim)
      ner=mdim
      iband=ndim
      nrs=ner-1
      nr=ner
      if (kkk.eq.2) go to 200
      do 120 n=1,nrs
      m=n-1
      mr=min0(iband,nr-m)
      pivot=ak(n,1)
      do 120 l=2,mr
      cp=ak(n,l)/pivot
      i=m+l
      j=0
      do 110 k=l,mr
      j=j+1
  110  ak(i,j)=ak(i,j)-cp*ak(n,k)
```

```
 120  ak(n,l)=cp
      go to 400
 200  do 220 n=1,nrs
      m=n-1
      mr=min0(iband,nr-m)
      cp=q(n)
      q(n)=cp/ak(n,1)
      do 220 l=2,mr
      i=m+l
 220  q(i)=q(i)-ak(n,l)*cp
      q(nr)=q(nr)/ak(nr,1)
      do 320 i=1,nrs
      n=nr-i
      m=n-1
      mr=min0(iband,nr-m)
      do 320 k=2,mr
      l=m+k
c
c  store computed displacements in load vector q
c234567
 320  q(n)=q(n)-ak(n,k)*q(l)
 400  return
      end

c*************************************************************
```

MATLAB Code

```
cord =  xlsread('cord');
ielmn = xlsread('ielmn');
disp = xlsread('displacements');
defcord = zeros(451,2);

for j = 2:3
    for k = 1:451
       defcord(k,(j-1)) = (cord(k,(j-1))) + ((disp(k,j))/5000);
    end
end


for i = 1:length(ielmn)
    xu = [cord(ielmn(i,1),1),cord(ielmn(i,2),1)];
    yu = [cord(ielmn(i,1),2),cord(ielmn(i,2),2)];
    plot(xu,yu,'k'); hold on;
    xlim([0 10.5]);
    ylim([-.5 1.5]);

    xd = [defcord(ielmn(i,1),1),defcord(ielmn(i,2),1)];
    yd = [defcord(ielmn(i,1),2),defcord(ielmn(i,2),2)];
    plot(xd,yd,'c'); hold on;
end


for i = 1:length(ielmn)
    xu = [cord(ielmn(i,2),1),cord(ielmn(i,3),1)];
    yd = [cord(ielmn(i,2),2),cord(ielmn(i,3),2)];
    plot(xu,yd,'k'); hold on;

    xd = [defcord(ielmn(i,2),1),defcord(ielmn(i,3),1)];
    yd = [defcord(ielmn(i,2),2),defcord(ielmn(i,3),2)];
    plot(xd,yd,'c'); hold on;
end


for i = 1:length(ielmn)
    xu = [cord(ielmn(i,3),1),cord(ielmn(i,4),1)];
    yu = [cord(ielmn(i,3),2),cord(ielmn(i,4),2)];
    plot(xu,yu,'k'); hold on;

    xd = [defcord(ielmn(i,3),1),defcord(ielmn(i,4),1)];
    yd = [defcord(ielmn(i,3),2),defcord(ielmn(i,4),2)];
    plot(xd,yd,'c'); hold on;
end


for i = 1:length(ielmn)
    xu = [cord(ielmn(i,4),1),cord(ielmn(i,1),1)];
    yu = [cord(ielmn(i,4),2),cord(ielmn(i,1),2)];
    plot(xu,yu,'k'); hold on;

    xd = [defcord(ielmn(i,4),1),defcord(ielmn(i,1),1)];
    yd = [defcord(ielmn(i,4),2),defcord(ielmn(i,1),2)];
    plot(xd,yd,'c'); hold on;
end

title('Cantilever Beam subjected to Distributed Load and Force at tip')
xlabel('Non-Dimensional Displacements in the x')
ylabel('Non-Dimensional Displacements in the y')
legend('Undeformed','Deformed')
```

```
for i = 1:1600
    sigma(i,1) = i;
end
sigma2 = zeros(451,2);
cord = zeros(451,2);

cord2 = xlsread('stresses');
sigma(:,2) = cord2(:,3);
dx = 10/40;
dy = 1/10;

p = 1;
for i = 0:40
    for j = 0:10
    cord(p,1) = 0+dx*i;
    cord(p,2) = 0+dy*j;
    p=p+1;
    end
end

j = [1;4;8;12;16;20;24;28;32;36;40];
k = [1562;1566;1570;1574;1578;1582;1586;1590;1594;1598;1599];
l = [441;442;443;444;445;446;447;448;449;450;451];

q = 1;
for i = 1:40;
    for p = 1:11
    sigma2(q,2) = sigma(j(p)+40*(i-1),2);
    q = q+1;
    end
end

    for p = 1:11
    sigma2(l(p),2) = sigma(k(p),2);
    end

for i = 1:451
    sigma2(i,1) = i;
end


x=min(cord(:,1)):(max(cord(:,1))-min(cord(:,1)))/200:max(cord(:,1));
y=min(cord(:,2)):(max(cord(:,2))-min(cord(:,2)))/200:max(cord(:,2));

[X, Y] = meshgrid(x,y);
Z =griddata(cord(:,1),cord(:,2),sigma2(:,2),X,Y);
contour(X,Y,Z,100)
title('Non-Dimensional Stress Contours')
xlabel('Non-dimenisonal Displacements in x')
ylabel('Nondimensional Displacements in Y')
```