

## EXERCISE 6 - CIRCULAR PLATE WITH MULTIPLE HOLES

### 1.- DATOS MALLA DE ELEMENTOS FINITOS

#### ■ NODOS

#### □ VALORES COORDENADAS NODOS

```
nodecoor =
{{1, {-1.35925, -0.85227}}, {2, {1.79965, -1.04346}},
 {3, {-0.65924, 1.05955}}, {4, {-1.50571, -0.49871}},
 {5, {-1.85915, -0.35227}}, {6, {-2.21288, -0.49880}},
 {7, {-2.35925, -0.85227}}, {8, {-2.21288, -1.20575}},
 {9, {-1.85915, -1.35227}}, {10, {-1.50571, -1.20584}},
 {11, {1.65634, -0.46230}}, {12, {1.25973, -0.01473}},
 {13, {0.70048, 0.19741}}, {14, {0.10654, 0.12537}}, {15, {-0.38620, -0.21479}},
 {16, {-0.66404, -0.74436}},
 {17, {-0.66404, -1.34256}}, {18, {-0.38620, -1.87213}},
 {19, {0.10654, -2.21228}}, {20, {0.70048, -2.28432}},
 {21, {1.25973, -2.07219}}, {22, {1.65634, -1.62462}},
 {23, {-0.79823, 1.53275}}, {24, {-1.17075, 1.85548}},
 {25, {-1.65854, 1.92568}}, {26, {-2.10735, 1.72074}},
 {27, {-2.37381, 1.30602}}, {28, {-2.37381, 0.81308}},
 {29, {-2.10735, 0.39836}}, {30, {-1.65854, 0.19343}},
 {31, {-1.17075, 0.26363}}, {32, {-0.79823, 0.58636}},
 {33, {2.65109, 0.13232}}, {34, {2.62740, 0.50858}}, {35, {2.55684, 0.87839}}, {36, {2.44042, 1.23669}},
 {37, {2.28001, 1.57758}}, {38, {2.07814, 1.89567}}, {39, {1.83788, 2.18609}}, {40, {1.56334, 2.44388}},
 {41, {1.25857, 2.66530}}, {42, {0.92843, 2.84680}}, {43, {0.57821, 2.98546}}, {44, {0.21348, 3.07913}},
 {45, {-0.16054, 3.12640}}, {46, {-0.53728, 3.12640}},
 {47, {-0.91105, 3.07918}}, {48, {-1.27596, 2.98549}},
 {49, {-1.62612, 2.84686}}, {50, {-1.95642, 2.66528}},
 {51, {-2.26118, 2.44386}}, {52, {-2.53581, 2.18596}},
 {53, {-2.77596, 1.89567}}, {54, {-2.97783, 1.57758}},
 {55, {-3.13836, 1.23638}}, {56, {-3.25469, 0.87827}},
 {57, {-3.32526, 0.50830}}, {58, {-3.34891, 0.13232}},
 {59, {-3.32526, -0.24367}}, {60, {-3.25469, -0.61364}},
 {61, {-3.13836, -0.97175}}, {62, {-2.97783, -1.31295}},
 {63, {-2.77596, -1.63104}}, {64, {-2.53581, -1.92133}},
 {65, {-2.26118, -2.17922}}, {66, {-1.95642, -2.40065}},
 {67, {-1.62612, -2.58222}}, {68, {-1.27596, -2.72085}},
 {69, {-0.91105, -2.81455}}, {70, {-0.53728, -2.86176}},
 {71, {-0.16054, -2.86176}}, {72, {0.21348, -2.81450}},
 {73, {0.57821, -2.72083}}, {74, {0.92843, -2.58216}},
 {75, {1.25857, -2.40067}}, {76, {1.56334, -2.17925}},
 {77, {1.83788, -1.92145}}, {78, {2.07814, -1.63104}},
 {79, {2.28001, -1.31295}}, {80, {2.44042, -0.97206}},
 {81, {2.55684, -0.61375}}, {82, {2.62740, -0.24395}},
 {83, {-2.08111, 2.16378}}, {84, {-1.91730, -2.05615}},
 {85, {-1.88738, -1.72539}}, {86, {-0.32616, 0.34708}},
 {87, {-2.88234, 0.64326}}, {88, {-2.56946, 0.36214}},
```

```
{89, {-2.38638, 0.09053}}, {90, {-2.11256, -0.06651}},
  {91, {-2.56112, -1.24946}}, {92, {-2.17779, -1.89001}},
{93, {-2.28716, -1.56789}}, {94, {-2.97534, 0.23861}},
  {95, {-2.45103, -0.23032}}, {96, {-2.69152, -0.01102}},
{97, {-3.03458, -0.20330}}, {98, {-2.57050, -0.57231}},
  {99, {-2.73232, -0.32378}}, {100, {-2.75351, -0.92678}},
{101, {-2.91399, -0.60193}}, {102, {-1.62513, -1.91359}},
  {103, {-0.94916, -1.67251}}, {104, {-0.34435, -2.53664}},
{105, {-1.59425, -2.22690}}, {106, {-1.26905, -1.98716}},
  {107, {-1.17086, -2.42120}}, {108, {-0.81763, -2.11673}},
{109, {-1.10044, -1.14419}}, {110, {-0.70165, -2.49974}},
  {111, {-0.42866, -2.24750}}, {112, {-2.43731, 1.79165}},
{113, {-2.74979, 1.47774}}, {114, {-2.79547, 1.05913}},
  {115, {-1.10402, -0.62002}}, {116, {-1.45658, -1.57157}},
{117, {-0.77934, 0.08361}}, {118, {-1.17329, -0.15124}},
  {119, {-0.82138, -0.32936}}, {120, {2.20794, -0.05916}},
{121, {2.45321, -0.04498}}, {122, {2.39429, -0.29238}},
  {123, {2.12615, -0.50006}}, {124, {0.63583, 2.58692}},
{125, {0.32174, 2.29803}}, {126, {-0.02877, 2.02782}},
  {127, {-0.39363, 1.77903}}, {128, {-1.61114, 2.41332}},
{129, {-1.19311, 2.20807}}, {130, {-0.79142, 1.99259}},
  {131, {0.24331, 2.69927}}, {132, {-0.41750, 2.18915}},
{133, {-0.08581, 2.42559}}, {134, {-1.15155, 2.67024}},
  {135, {-0.77530, 2.39109}}, {136, {-0.66814, 2.76770}},
{137, {-0.43006, 2.51880}}, {138, {-0.20358, 2.82047}},
  {139, {0.01857, 1.60135}}, {140, {0.41995, 1.44126}},
{141, {0.79972, 1.25840}}, {142, {1.18778, 1.04865}},
  {143, {1.60187, 0.86328}}, {144, {1.98306, 0.70495}},
{145, {2.31237, 0.59123}}, {146, {2.06177, 0.30145}},
  {147, {2.38563, 0.23824}}, {148, {0.45170, 1.05916}},
{149, {0.20798, 0.64745}}, {150, {0.07437, 1.15569}},
  {151, {-0.34430, 1.33047}}, {152, {-0.30760, 0.85443}},
{153, {1.65454, 0.39067}}, {154, {1.19351, 0.54637}},
  {155, {0.75686, 0.79291}}, {156, {1.82775, -0.05735}},
{157, {0.38419, 1.87371}}, {158, {0.78193, 2.17477}},
  {159, {0.79203, 1.69898}}, {160, {1.20304, 2.31191}},
{161, {1.17559, 1.93653}}, {162, {1.19129, 1.50911}},
  {163, {0.96156, 2.51714}}, {164, {2.26028, 0.91570}},
{165, {1.58493, 1.32155}}, {166, {2.00892, 1.16718}},
  {167, {1.47757, 2.13378}}, {168, {1.60819, 1.79046}},
{169, {1.91204, 1.55049}}};
```

#### □ NUMERO DE NODOS

```
xy = nodecoor;
```

```
numnod = Length[xy];
```

#### □ DEFINICION ESTRUCTURA DATOS DE NODOS

```
NodeCoordinates = Table[xy[[i, 2]], {i, 1, numnod}];
```

## ■ ELEMENTOS

### □ CONECTIVIDAD DE NODOS EN ELEMENTOS

```

elemnodes = {{1, {1, 115, 4}}, {2, {10, 109, 1}}, {3, {115, 1, 109}}, {4, {2, 123, 11}},
{5, {2, 22, 78}}, {6, {78, 79, 2}}, {7, {79, 80, 2}}, {8, {2, 80, 123}},
{9, {3, 151, 23}}, {10, {3, 32, 152}}, {11, {151, 3, 152}}, {12, {4, 30, 5}},
{13, {4, 118, 30}}, {14, {115, 118, 4}}, {15, {5, 90, 6}}, {16, {5, 30, 90}},
{17, {6, 98, 7}}, {18, {90, 95, 6}}, {19, {95, 98, 6}}, {20, {7, 91, 8}},
{21, {91, 7, 100}}, {22, {98, 100, 7}}, {23, {8, 93, 9}}, {24, {8, 91, 93}},
{25, {9, 116, 10}}, {26, {9, 93, 85}}, {27, {9, 85, 116}}, {28, {109, 10, 116}},
{29, {11, 156, 12}}, {30, {156, 123, 120}}, {31, {123, 156, 11}}, {32, {12, 154, 13}},
{33, {153, 154, 12}}, {34, {153, 12, 156}}, {35, {13, 149, 14}}, {36, {149, 155, 148}},
{37, {149, 13, 155}}, {38, {154, 155, 13}}, {39, {14, 86, 15}}, {40, {14, 149, 86}},
{41, {15, 119, 16}}, {42, {86, 117, 15}}, {43, {15, 117, 119}}, {44, {17, 16, 109}},
{45, {16, 119, 115}}, {46, {18, 17, 103}}, {47, {109, 116, 103}}, {48, {115, 109, 16}},
{49, {18, 111, 19}}, {50, {18, 108, 111}}, {51, {103, 108, 18}}, {52, {19, 73, 20}},
{53, {72, 73, 19}}, {54, {72, 19, 71}}, {55, {19, 111, 104}}, {56, {20, 75, 21}},
{57, {73, 74, 20}}, {58, {74, 75, 20}}, {59, {21, 76, 22}}, {60, {75, 76, 21}},
{61, {76, 77, 22}}, {62, {77, 78, 22}}, {63, {23, 130, 24}}, {64, {127, 130, 23}},
{65, {127, 23, 151}}, {66, {24, 129, 25}}, {67, {129, 24, 130}}, {68, {25, 83, 26}},
{69, {25, 128, 83}}, {70, {128, 25, 129}}, {71, {26, 112, 27}}, {72, {26, 83, 112}},
{73, {27, 114, 28}}, {74, {112, 113, 27}}, {75, {113, 114, 27}}, {76, {28, 88, 29}},
{77, {87, 88, 28}}, {78, {87, 28, 114}}, {79, {29, 90, 30}}, {80, {29, 88, 89}},
{81, {29, 89, 90}}, {82, {30, 118, 31}}, {83, {31, 117, 32}}, {84, {117, 31, 118}},
{85, {86, 32, 117}}, {86, {86, 152, 32}}, {87, {33, 34, 147}}, {88, {33, 121, 82}},
{89, {33, 147, 121}}, {90, {34, 35, 145}}, {91, {145, 147, 34}}, {92, {35, 36, 164}},
{93, {35, 164, 145}}, {94, {36, 166, 164}}, {95, {37, 38, 169}}, {96, {36, 37, 166}},
{97, {37, 169, 166}}, {98, {38, 39, 168}}, {99, {38, 168, 169}}, {100, {39, 40, 167}},
{101, {39, 167, 168}}, {102, {40, 41, 160}}, {103, {40, 160, 167}}, {104, {41, 42, 163}},
{105, {41, 163, 160}}, {106, {42, 43, 124}}, {107, {42, 124, 163}}, {108, {43, 44, 131}},
{109, {124, 43, 131}}, {110, {44, 45, 138}}, {111, {44, 138, 131}}, {112, {45, 46, 138}},
{113, {46, 47, 136}}, {114, {136, 138, 46}}, {115, {136, 137, 138}}, {116, {47, 48, 134}},
{117, {47, 134, 136}}, {118, {49, 134, 48}}, {119, {49, 128, 134}}, {120, {49, 50, 128}},
{121, {50, 83, 128}}, {122, {51, 52, 83}}, {123, {51, 83, 50}}, {124, {52, 53, 112}},
{125, {52, 112, 83}}, {126, {53, 54, 113}}, {127, {112, 53, 113}}, {128, {54, 55, 113}},
{129, {55, 56, 114}}, {130, {113, 55, 114}}, {131, {56, 57, 87}}, {132, {87, 114, 56}},
{133, {57, 58, 94}}, {134, {87, 57, 94}}, {135, {58, 59, 97}}, {136, {58, 97, 94}},
{137, {59, 60, 97}}, {138, {60, 61, 101}}, {139, {97, 101, 99}}, {140, {97, 60, 101}},
{141, {61, 62, 100}}, {142, {100, 101, 61}}, {143, {62, 63, 91}}, {144, {91, 100, 62}},
{145, {63, 64, 93}}, {146, {63, 93, 91}}, {147, {64, 65, 92}}, {148, {64, 92, 93}},
{149, {65, 66, 84}}, {150, {65, 84, 92}}, {151, {66, 67, 105}}, {152, {84, 66, 105}},
{153, {67, 107, 105}}, {154, {68, 69, 107}}, {155, {67, 68, 107}}, {156, {69, 70, 110}},
{157, {69, 110, 107}}, {158, {70, 71, 104}}, {159, {70, 104, 110}}, {160, {104, 71, 19}},
{161, {81, 123, 80}}, {162, {81, 122, 123}}, {163, {81, 82, 122}}, {164, {82, 121, 122}},
{165, {84, 85, 92}}, {166, {84, 102, 85}}, {167, {84, 105, 102}}, {168, {85, 93, 92}},
{169, {85, 102, 116}}, {170, {86, 149, 152}}, {171, {87, 94, 88}}, {172, {88, 96, 89}},
{173, {96, 88, 94}}, {174, {90, 89, 95}}, {175, {95, 89, 96}}, {176, {94, 97, 96}},
{177, {95, 96, 99}}, {178, {95, 99, 98}}, {179, {96, 97, 99}}, {180, {98, 99, 101}},
{181, {98, 101, 100}}, {182, {106, 116, 102}}, {183, {106, 103, 116}}, {184, {105, 106, 102}},
{185, {17, 109, 103}}, {186, {104, 111, 110}}, {187, {105, 107, 106}}, {188, {106, 107, 108}},
{189, {106, 108, 103}}, {190, {108, 107, 110}}, {191, {108, 110, 111}}, {192, {115, 119, 118}},
{193, {117, 118, 119}}, {194, {120, 122, 121}}, {195, {146, 120, 147}}, {196, {120, 123, 122}},

```

```
{197, {146, 156, 120}}, {198, {120, 121, 147}}, {199, {124, 131, 125}}, {200, {124, 125, 158}},
{201, {124, 158, 163}}, {202, {133, 126, 125}}, {203, {126, 157, 125}}, {204, {133, 125, 131}},
{205, {125, 157, 158}}, {206, {126, 132, 127}}, {207, {139, 126, 127}}, {208, {126, 133, 132}},
{209, {126, 139, 157}}, {210, {127, 132, 130}}, {211, {139, 127, 151}}, {212, {128, 129, 134}},
{213, {135, 129, 130}}, {214, {129, 135, 134}}, {215, {135, 130, 132}}, {216, {131, 138, 133}},
{217, {132, 133, 137}}, {218, {132, 137, 135}}, {219, {133, 138, 137}}, {220, {135, 136, 134}},
{221, {135, 137, 136}}, {222, {150, 140, 139}}, {223, {157, 139, 140}}, {224, {139, 151, 150}},
{225, {140, 148, 141}}, {226, {159, 140, 141}}, {227, {140, 150, 148}}, {228, {159, 157, 140}},
{229, {141, 155, 142}}, {230, {162, 141, 142}}, {231, {141, 148, 155}}, {232, {162, 159, 141}},
{233, {143, 142, 154}}, {234, {143, 165, 142}}, {235, {142, 155, 154}}, {236, {142, 165, 162}},
{237, {143, 153, 144}}, {238, {143, 144, 166}}, {239, {143, 154, 153}}, {240, {143, 166, 165}},
{241, {144, 146, 145}}, {242, {144, 145, 164}}, {243, {144, 153, 146}}, {244, {144, 164, 166}},
{245, {145, 146, 147}}, {246, {146, 153, 156}}, {247, {148, 150, 149}}, {248, {150, 152, 149}},
{249, {152, 150, 151}}, {250, {157, 159, 158}}, {251, {159, 161, 158}}, {252, {160, 158, 161}},
{253, {158, 160, 163}}, {254, {161, 159, 162}}, {255, {160, 161, 167}}, {256, {161, 162, 168}},
{257, {161, 168, 167}}, {258, {162, 165, 168}}, {259, {165, 166, 169}}, {260, {165, 169, 168}}};
```

#### □ NUMERO DE ELEMENTOS

```
ijk = elemnodes;
```

```
numele = Length[ijk];
```

#### □ DEFINICION ESTRUCTURA DATOS DE ELEMENTOS

```
ElemNodes = Table[ijk[[i, 2]], {i, 1, numele}];
```

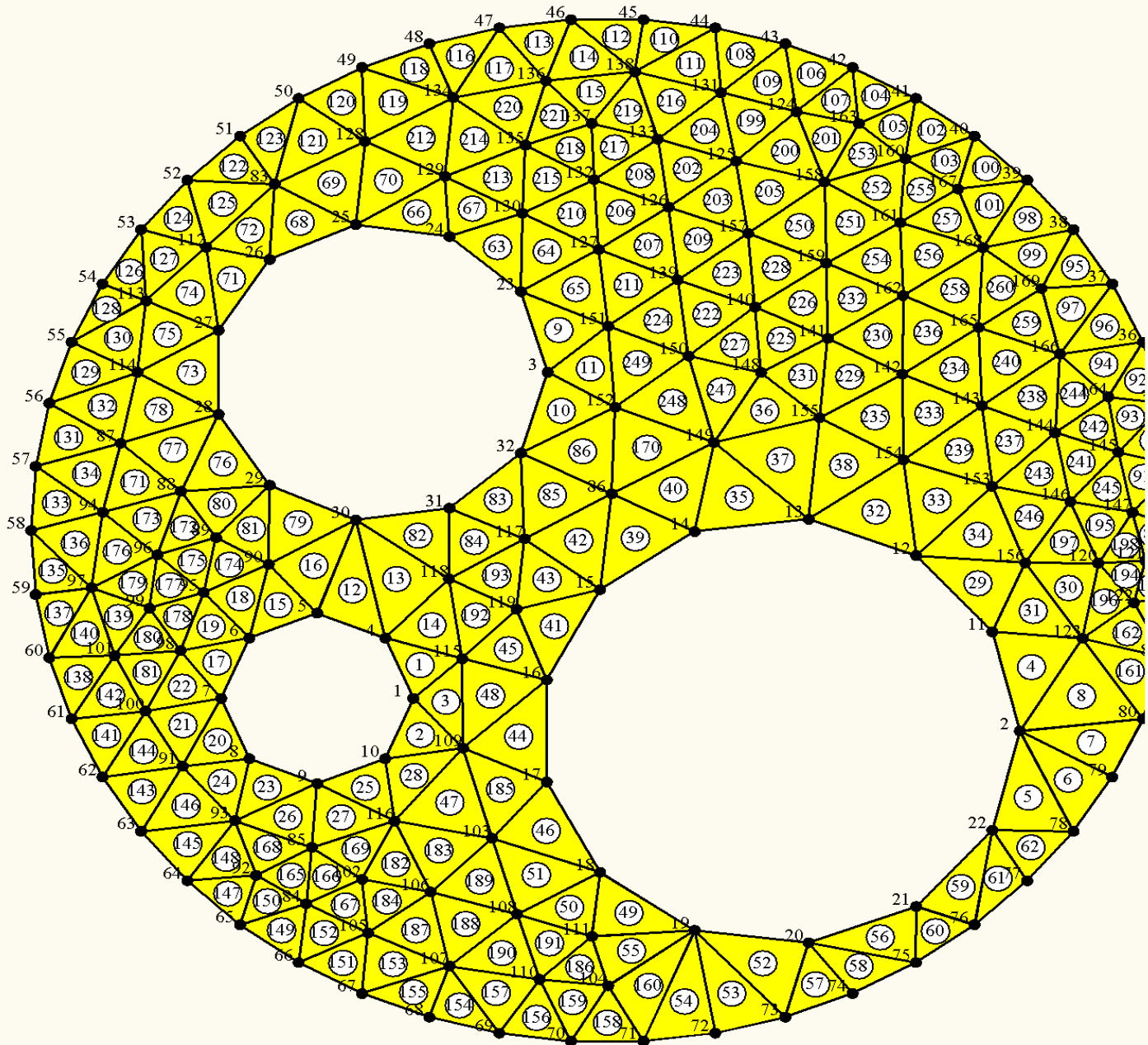
#### ■ VISUALIZACION DE LA MALLA DE ELEMENTOS FINITOS

```
Clear[aspect]
```

```
aspect = 1;
```

```
Plot2DElementsAndNodes [NodeCoordinates, ElemNodes, aspect,
"Circle Mesh", True, True];
```

Circle Mesh



## ■ MATERIAL

```
ClearAll[Em, v, th, x0, y0, aspect, Nsub];
Em = 1000; v = 0; th = 1; aspect = 1; Nsub = 4;
Emat = Em / (1 - v^2) * {{1, v, 0}, {v, 1, 0}, {0, 0, (1 - v) / 2}};
```

## ■ ASIGNACION DE MATERIAL Y ESPESOR A ELEMENTOS

```
ElemMaterials = Table[Emat, {numele}];
ElemFabrications = Table[th, {numele}];
```

```
PrintPlaneStressElementMatFab[ElemMaterials, ElemFabrications, "", {}];
```

elem	material	fabrication
1	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
2	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
3	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
4	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
5	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
6	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
7	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
8	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
9	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
10	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
11	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
12	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
13	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
14	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
15	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
16	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
17	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
18	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
19	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
20	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
21	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
22	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
23	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
24	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
25	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
26	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
27	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
28	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
29	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
30	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
31	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
32	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
33	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
34	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
35	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
36	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
37	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
38	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
39	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
40	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
41	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
42	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
43	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
44	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
45	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
46	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
47	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
48	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
49	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
50	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
51	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
52	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
53	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
54	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
55	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
56	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
57	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
58	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
59	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1
60	{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}	1







```

231  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
232  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
233  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
234  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
235  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
236  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
237  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
238  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
239  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
240  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
241  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
242  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
243  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
244  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
245  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
246  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
247  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
248  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
249  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
250  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
251  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
252  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
253  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
254  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
255  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
256  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
257  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
258  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
259  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1
260  {{1000, 0, 0}, {0, 1000, 0}, {0, 0, 500}} 1

```

#### ■ SELECCION TIPO DE ELEMENTO

```
ElemTypes = Table["Trig3", {numele}];
```

#### ■ ASIGNACION DE CONDICIONES DE CONTORNO - DESPLAZAMIENTOS PREESTABLECIDOS

##### □ INICIALIZACION

```
NodeDOFValues = NodeDOFTags = Table[{0, 0}, {numnod}];
```

##### □ DEFINICION CONDICIONES DE CONTORNO EN DESPLAZAMIENTOS

```
NodeDOFTags[[58]] = {1, 1}; NodeDOFTags[[33]] = {0, 1};
```

#### ■ ASIGNACION DE CONDICIONES DE CONTORNO - CARGAS NODALES

```

x0 = -0.348906; y0 = 0.132318;
For [n = 33, n <= 82, n++, {xn, yn} = NodeCoordinates[[n]];
  LL = (xn - x0)^2 + (yn - y0)^2;
  NodeDOFValues[[n]] = Chop[3*{-(xn - x0)/LL, -(yn - y0)/LL}, 0.000001];

```

#### ■ LISTADO DE CONDICIONES DE CONTORNO

```
PrintPlaneStressFreedomActivity[NodeDOFTags, NodeDOFValues, "", {}];
```

node	x-tag	y-tag	x-value	y-value
1	0	0	0.00	0.00
2	0	0	0.00	0.00
3	0	0	0.00	0.00
4	0	0	0.00	0.00
5	0	0	0.00	0.00
6	0	0	0.00	0.00
7	0	0	0.00	0.00
8	0	0	0.00	0.00
9	0	0	0.00	0.00
10	0	0	0.00	0.00
11	0	0	0.00	0.00

12	0	0	0.00	0.00
13	0	0	0.00	0.00
14	0	0	0.00	0.00
15	0	0	0.00	0.00
16	0	0	0.00	0.00
17	0	0	0.00	0.00
18	0	0	0.00	0.00
19	0	0	0.00	0.00
20	0	0	0.00	0.00
21	0	0	0.00	0.00
22	0	0	0.00	0.00
23	0	0	0.00	0.00
24	0	0	0.00	0.00
25	0	0	0.00	0.00
26	0	0	0.00	0.00
27	0	0	0.00	0.00
28	0	0	0.00	0.00
29	0	0	0.00	0.00
30	0	0	0.00	0.00
31	0	0	0.00	0.00
32	0	0	0.00	0.00
33	0	1	-1.00	0.00
34	0	0	-0.99	-0.13
35	0	0	-0.97	-0.25
36	0	0	-0.93	-0.37
37	0	0	-0.88	-0.48
38	0	0	-0.81	-0.59
39	0	0	-0.73	-0.68
40	0	0	-0.64	-0.77
41	0	0	-0.54	-0.84
42	0	0	-0.43	-0.90
43	0	0	-0.31	-0.95
44	0	0	-0.19	-0.98
45	0	0	-0.06	-1.00
46	0	0	0.06	-1.00
47	0	0	0.19	-0.98
48	0	0	0.31	-0.95
49	0	0	0.43	-0.90
50	0	0	0.54	-0.84
51	0	0	0.64	-0.77
52	0	0	0.73	-0.68
53	0	0	0.81	-0.59
54	0	0	0.88	-0.48
55	0	0	0.93	-0.37
56	0	0	0.97	-0.25
57	0	0	0.99	-0.13
58	1	1	1.00	0.00
59	0	0	0.99	0.13
60	0	0	0.97	0.25
61	0	0	0.93	0.37
62	0	0	0.88	0.48
63	0	0	0.81	0.59
64	0	0	0.73	0.68
65	0	0	0.64	0.77
66	0	0	0.54	0.84
67	0	0	0.43	0.90
68	0	0	0.31	0.95
69	0	0	0.19	0.98
70	0	0	0.06	1.00
71	0	0	-0.06	1.00
72	0	0	-0.19	0.98
73	0	0	-0.31	0.95
74	0	0	-0.43	0.90
75	0	0	-0.54	0.84
76	0	0	-0.64	0.77
77	0	0	-0.73	0.68
78	0	0	-0.81	0.59
79	0	0	-0.88	0.48
80	0	0	-0.93	0.37
81	0	0	-0.97	0.25
82	0	0	-0.99	0.13
83	0	0	0.00	0.00
84	0	0	0.00	0.00
85	0	0	0.00	0.00
86	0	0	0.00	0.00
87	0	0	0.00	0.00
88	0	0	0.00	0.00
89	0	0	0.00	0.00
90	0	0	0.00	0.00
91	0	0	0.00	0.00
92	0	0	0.00	0.00
93	0	0	0.00	0.00
94	0	0	0.00	0.00
95	0	0	0.00	0.00
96	0	0	0.00	0.00

97	0	0	0.00	0.00
98	0	0	0.00	0.00
99	0	0	0.00	0.00
100	0	0	0.00	0.00
101	0	0	0.00	0.00
102	0	0	0.00	0.00
103	0	0	0.00	0.00
104	0	0	0.00	0.00
105	0	0	0.00	0.00
106	0	0	0.00	0.00
107	0	0	0.00	0.00
108	0	0	0.00	0.00
109	0	0	0.00	0.00
110	0	0	0.00	0.00
111	0	0	0.00	0.00
112	0	0	0.00	0.00
113	0	0	0.00	0.00
114	0	0	0.00	0.00
115	0	0	0.00	0.00
116	0	0	0.00	0.00
117	0	0	0.00	0.00
118	0	0	0.00	0.00
119	0	0	0.00	0.00
120	0	0	0.00	0.00
121	0	0	0.00	0.00
122	0	0	0.00	0.00
123	0	0	0.00	0.00
124	0	0	0.00	0.00
125	0	0	0.00	0.00
126	0	0	0.00	0.00
127	0	0	0.00	0.00
128	0	0	0.00	0.00
129	0	0	0.00	0.00
130	0	0	0.00	0.00
131	0	0	0.00	0.00
132	0	0	0.00	0.00
133	0	0	0.00	0.00
134	0	0	0.00	0.00
135	0	0	0.00	0.00
136	0	0	0.00	0.00
137	0	0	0.00	0.00
138	0	0	0.00	0.00
139	0	0	0.00	0.00
140	0	0	0.00	0.00
141	0	0	0.00	0.00
142	0	0	0.00	0.00
143	0	0	0.00	0.00
144	0	0	0.00	0.00
145	0	0	0.00	0.00
146	0	0	0.00	0.00
147	0	0	0.00	0.00
148	0	0	0.00	0.00
149	0	0	0.00	0.00
150	0	0	0.00	0.00
151	0	0	0.00	0.00
152	0	0	0.00	0.00
153	0	0	0.00	0.00
154	0	0	0.00	0.00
155	0	0	0.00	0.00
156	0	0	0.00	0.00
157	0	0	0.00	0.00
158	0	0	0.00	0.00
159	0	0	0.00	0.00
160	0	0	0.00	0.00
161	0	0	0.00	0.00
162	0	0	0.00	0.00
163	0	0	0.00	0.00
164	0	0	0.00	0.00
165	0	0	0.00	0.00
166	0	0	0.00	0.00
167	0	0	0.00	0.00
168	0	0	0.00	0.00
169	0	0	0.00	0.00

### 3.- SOLUCION DEL PROBLEMA E IMPRESION DE RESULTADOS

#### ■ SOLUCION DEL PROBLEMA

```
{NodeDisplacements, NodeForces, NodePlateCounts, NodePlateStresses,
ElemBarNumbers, ElemBarForces} = PlaneStressSolution[
NodeCoordinates, ElemTypes, ElemNodes,
ElemMaterials, ElemFabrications,
NodeDOFTags, NodeDOFValues, ProcessOptions];
```

#### ■ IMPRESION DE RESULTADOS

```
PrintPlaneStressSolution[NodeDisplacements, NodeForces, NodePlateCounts,
NodePlateStresses, "Computed Solution:", {}];
```

Computed Solution:

node	x-displ	y-displ	x-force	y-force	sigma-xx	sigma-yy	sigma-xy
1	0.9922	0.0070	0.0000	0.0000	-1.8157	-7.0823	-0.2014
2	0.9698	0.0097	0.0000	0.0000	-2.4040	-8.5837	-0.9288
3	0.9841	-0.0028	0.0000	0.0000	-1.7089	-5.2955	-0.4213
4	0.9925	0.0041	0.0000	0.0000	-4.3958	-3.7954	0.7153
5	0.9949	0.0029	0.0000	0.0000	-6.2188	-1.6259	0.4447
6	0.9974	0.0030	0.0000	0.0000	-3.8253	-3.4200	-0.7766
7	0.9985	0.0050	0.0000	0.0000	-2.2752	-5.1977	0.5368
8	0.9978	0.0077	0.0000	0.0000	-3.7829	-4.0170	2.0631
9	0.9958	0.0096	0.0000	0.0000	-4.7032	-2.6401	0.5429
10	0.9937	0.0095	0.0000	0.0000	-3.0544	-4.7945	-1.1581
11	0.9726	0.0043	0.0000	0.0000	-2.3632	-6.8850	2.3496
12	0.9763	0.0009	0.0000	0.0000	-4.2440	-3.6603	2.3616
13	0.9801	-0.0006	0.0000	0.0000	-5.4210	-1.8699	0.4912
14	0.9840	-0.0000	0.0000	0.0000	-5.5385	-2.4032	-2.0976
15	0.9881	0.0027	0.0000	0.0000	-4.0212	-4.7917	-3.0435
16	0.9912	0.0069	0.0000	0.0000	-1.8138	-6.9959	-1.3156
17	0.9925	0.0118	0.0000	0.0000	-1.6387	-6.7556	1.1359
18	0.9917	0.0168	0.0000	0.0000	-4.3208	-4.5041	2.7865
19	0.9882	0.0218	0.0000	0.0000	-7.7216	-2.5051	1.3107
20	0.9823	0.0259	0.0000	0.0000	-11.5208	-2.7144	-2.7141
21	0.9737	0.0246	0.0000	0.0000	-10.2683	-5.9366	-6.2408
22	0.9688	0.0171	0.0000	0.0000	-5.6153	-9.3813	-5.2417
23	0.9844	-0.0056	0.0000	0.0000	-2.8810	-3.8027	1.6000
24	0.9867	-0.0078	0.0000	0.0000	-5.3627	-1.9372	1.6451
25	0.9901	-0.0087	0.0000	0.0000	-6.1693	-1.9340	-0.7016
26	0.9941	-0.0080	0.0000	0.0000	-4.8508	-3.8270	-2.7306
27	0.9970	-0.0053	0.0000	0.0000	-2.4128	-5.9444	-1.5654
28	0.9978	-0.0018	0.0000	0.0000	-1.9762	-5.4926	0.8309
29	0.9965	0.0011	0.0000	0.0000	-4.0283	-3.1496	1.7076
30	0.9934	0.0026	0.0000	0.0000	-6.1879	-1.8426	0.5626
31	0.9898	0.0026	0.0000	0.0000	-5.6369	-2.9972	-2.2737
32	0.9864	0.0001	0.0000	0.0000	-3.6478	-4.6893	-2.6513
33	0.9724	0.0000	-1.0000	$-4.5276 \times 10^{-6}$	-2.7007	-3.3778	0.1289
34	0.9734	-0.0011	-0.9921	-0.1254	-2.7021	-3.1286	0.1186
35	0.9742	-0.0020	-0.9686	-0.2487	-2.7048	-2.9185	0.1023
36	0.9750	-0.0029	-0.9298	-0.3681	-2.7533	-2.7936	0.1142
37	0.9757	-0.0037	-0.8763	-0.4818	-2.7230	-2.7316	0.0519
38	0.9764	-0.0044	-0.8090	-0.5878	-2.7249	-2.6799	0.0286
39	0.9772	-0.0051	-0.7289	-0.6846	-2.6759	-2.6835	-0.0079
40	0.9779	-0.0057	-0.6374	-0.7705	-2.6639	-2.6679	-0.0123
41	0.9786	-0.0064	-0.5358	-0.8443	-2.6569	-2.6877	0.0038
42	0.9793	-0.0070	-0.4258	-0.9048	-2.6846	-2.6873	0.0161
43	0.9802	-0.0077	-0.3090	-0.9511	-2.7473	-2.6899	0.0485
44	0.9811	-0.0083	-0.1875	-0.9823	-2.8454	-2.6840	0.0613
45	0.9821	-0.0089	-0.0628	-0.9980	-2.8820	-2.7062	0.0663
46	0.9832	-0.0094	0.0628	-0.9980	-3.0990	-2.6698	0.0748
47	0.9844	-0.0099	0.1874	-0.9823	-3.4112	-2.6307	-0.0112
48	0.9859	-0.0104	0.3090	-0.9511	-3.6943	-2.6506	-0.1107
49	0.9876	-0.0107	0.4257	-0.9048	-4.1082	-2.6517	-0.3961
50	0.9895	-0.0107	0.5358	-0.8443	-4.5218	-2.9399	-0.9797
51	0.9916	-0.0104	0.6374	-0.7705	-4.4440	-3.3985	-1.3322
52	0.9938	-0.0096	0.7290	-0.6845	-4.2915	-4.0539	-1.8002
53	0.9959	-0.0084	0.8090	-0.5878	-3.6840	-4.8316	-1.8250
54	0.9977	-0.0067	0.8763	-0.4818	-3.1120	-5.2235	-1.3926
55	0.9987	-0.0049	0.9298	-0.3680	-2.6675	-5.3097	-0.8236
56	0.9994	-0.0031	0.9686	-0.2486	-2.4777	-4.8437	-0.2796
57	0.9998	-0.0015	0.9921	-0.1253	-2.5568	-4.2312	0.0787
58	1.0000	0.0000	1.0001	$-4.5277 \times 10^{-6}$	-2.6818	-3.8264	0.1510
59	1.0001	0.0014	0.9921	0.1253	-2.7203	-3.6242	0.1334
60	1.0003	0.0028	0.9686	0.2487	-2.6870	-3.7347	0.1750
61	1.0003	0.0043	0.9298	0.3680	-2.6677	-3.8693	0.3690
62	1.0001	0.0059	0.8763	0.4818	-2.8844	-3.8511	0.7260
63	0.9997	0.0075	0.8090	0.5878	-3.1840	-3.5326	0.8309

64	0.9993	0.0090	0.7290	0.6845	-3.3338	-3.1090	0.6355
65	0.9987	0.0104	0.6374	0.7705	-3.3495	-2.8864	0.4376
66	0.9982	0.0119	0.5358	0.8443	-3.2529	-2.7723	0.2485
67	0.9977	0.0133	0.4257	0.9048	-3.2401	-2.8042	0.2252
68	0.9971	0.0150	0.3090	0.9511	-3.2087	-2.8827	0.2469
69	0.9962	0.0169	0.1874	0.9823	-3.6518	-2.8839	0.4243
70	0.9951	0.0190	0.0628	0.9980	-4.4452	-2.8932	0.6527
71	0.9932	0.0214	-0.0628	0.9980	-5.8334	-2.5248	0.9368
72	0.9905	0.0238	-0.1875	0.9823	-7.8145	-2.1862	0.6772
73	0.9867	0.0259	-0.3090	0.9510	-10.2437	-1.6325	-0.5701
74	0.9819	0.0269	-0.4258	0.9048	-11.5263	-2.2757	-3.0408
75	0.9765	0.0261	-0.5358	0.8443	-11.4653	-4.2213	-5.5486
76	0.9715	0.0229	-0.6374	0.7705	-8.7544	-7.3994	-6.7842
77	0.9685	0.0182	-0.7289	0.6846	-5.4194	-9.0919	-5.6479
78	0.9674	0.0132	-0.8090	0.5878	-3.0429	-9.6394	-3.4803
79	0.9677	0.0090	-0.8763	0.4818	-2.4244	-8.1896	-1.3348
80	0.9687	0.0057	-0.9298	0.3681	-2.3193	-6.5561	-0.3139
81	0.9700	0.0032	-0.9686	0.2487	-2.6773	-4.8159	0.1729
82	0.9713	0.0013	-0.9921	0.1254	-2.6893	-3.8591	0.0726
83	0.9919	-0.0093	0.0000	0.0000	-4.9004	-3.0656	-1.7067
84	0.9974	0.0110	0.0000	0.0000	-3.5320	-2.7582	0.4091
85	0.9966	0.0103	0.0000	0.0000	-4.0375	-2.4945	0.4729
86	0.9856	0.0004	0.0000	0.0000	-4.1715	-3.5532	-2.4752
87	0.9986	-0.0018	0.0000	0.0000	-2.2605	-4.6903	0.3258
88	0.9978	-0.0001	0.0000	0.0000	-2.7374	-4.1758	1.1353
89	0.9973	0.0013	0.0000	0.0000	-3.5826	-3.0318	0.9304
90	0.9960	0.0021	0.0000	0.0000	-5.1369	-2.1258	0.4891
91	0.9988	0.0066	0.0000	0.0000	-2.8675	-4.1858	1.2414
92	0.9980	0.0098	0.0000	0.0000	-3.5981	-2.9073	0.6732
93	0.9981	0.0085	0.0000	0.0000	-3.8175	-3.0482	1.1795
94	0.9990	-0.0002	0.0000	0.0000	-2.6710	-4.0599	0.3175
95	0.9977	0.0022	0.0000	0.0000	-3.3225	-3.2464	-0.1455
96	0.9983	0.0012	0.0000	0.0000	-2.9101	-3.7027	0.3901
97	0.9993	0.0015	0.0000	0.0000	-2.7065	-3.8077	0.1820
98	0.9984	0.0034	0.0000	0.0000	-2.4081	-4.3571	-0.3100
99	0.9986	0.0023	0.0000	0.0000	-2.7351	-3.8943	0.0481
100	0.9992	0.0048	0.0000	0.0000	-2.4257	-4.2582	0.4583
101	0.9993	0.0032	0.0000	0.0000	-2.6286	-3.9693	0.1727
102	0.9960	0.0114	0.0000	0.0000	-3.7246	-2.9634	0.2868
103	0.9933	0.0126	0.0000	0.0000	-2.6793	-4.9912	1.2128
104	0.9926	0.0193	0.0000	0.0000	-5.4028	-2.7912	1.1379
105	0.9966	0.0124	0.0000	0.0000	-3.4152	-2.9277	0.3573
106	0.9949	0.0128	0.0000	0.0000	-3.4051	-3.4863	0.6106
107	0.9957	0.0146	0.0000	0.0000	-3.5358	-2.9891	0.5330
108	0.9936	0.0152	0.0000	0.0000	-3.8655	-3.6051	1.5502
109	0.9926	0.0093	0.0000	0.0000	-1.6304	-6.2017	-0.3400
110	0.9941	0.0170	0.0000	0.0000	-4.3198	-2.9741	0.8794
111	0.9920	0.0179	0.0000	0.0000	-5.5339	-3.2126	2.2222
112	0.9950	-0.0079	0.0000	0.0000	-3.7699	-4.6019	-2.2351
113	0.9972	-0.0063	0.0000	0.0000	-2.7889	-5.3723	-1.4065
114	0.9981	-0.0039	0.0000	0.0000	-2.0419	-5.6107	-0.4208
115	0.9915	0.0058	0.0000	0.0000	-2.1450	-5.9736	-0.4103
116	0.9945	0.0108	0.0000	0.0000	-3.5165	-3.4999	-0.1807
117	0.9885	0.0023	0.0000	0.0000	-4.1605	-4.0444	-2.6844
118	0.9908	0.0035	0.0000	0.0000	-4.5694	-3.4713	-0.9296
119	0.9899	0.0043	0.0000	0.0000	-3.1286	-5.4938	-2.0770
120	0.9730	0.0018	0.0000	0.0000	-2.6461	-4.4635	0.6444
121	0.9724	0.0012	0.0000	0.0000	-2.6619	-3.8146	0.1961
122	0.9717	0.0024	0.0000	0.0000	-2.6390	-4.3884	0.1805
123	0.9716	0.0043	0.0000	0.0000	-2.3229	-5.9702	0.7352
124	0.9803	-0.0066	0.0000	0.0000	-2.8038	-2.7327	0.1155
125	0.9814	-0.0060	0.0000	0.0000	-2.9583	-2.8293	0.2877
126	0.9825	-0.0057	0.0000	0.0000	-3.0274	-2.9789	0.5503
127	0.9836	-0.0055	0.0000	0.0000	-2.8714	-3.2845	1.0459
128	0.9887	-0.0095	0.0000	0.0000	-4.8470	-2.3298	-0.5595
129	0.9869	-0.0084	0.0000	0.0000	-5.0745	-1.9093	0.6198
130	0.9851	-0.0070	0.0000	0.0000	-3.9460	-2.5420	1.4549
131	0.9814	-0.0072	0.0000	0.0000	-2.9078	-2.7167	0.1600
132	0.9837	-0.0067	0.0000	0.0000	-3.4187	-2.7497	0.7495
133	0.9825	-0.0069	0.0000	0.0000	-3.1409	-2.7496	0.3821
134	0.9861	-0.0093	0.0000	0.0000	-3.9909	-2.5047	0.0314
135	0.9850	-0.0079	0.0000	0.0000	-3.8749	-2.4814	0.5769
136	0.9841	-0.0087	0.0000	0.0000	-3.4336	-2.6030	0.1720
137	0.9836	-0.0076	0.0000	0.0000	-3.4072	-2.6474	0.4082
138	0.9826	-0.0081	0.0000	0.0000	-3.0742	-2.6828	0.1629
139	0.9825	-0.0043	0.0000	0.0000	-2.8574	-3.3633	0.3934
140	0.9813	-0.0034	0.0000	0.0000	-3.2281	-3.0678	0.1705
141	0.9801	-0.0027	0.0000	0.0000	-3.4843	-2.7471	0.2761
142	0.9786	-0.0019	0.0000	0.0000	-3.5578	-2.7675	0.5992
143	0.9770	-0.0013	0.0000	0.0000	-3.3302	-3.0195	0.7454
144	0.9755	-0.0009	0.0000	0.0000	-2.9211	-3.2541	0.5955
145	0.9744	-0.0008	0.0000	0.0000	-2.7299	-3.2664	0.3033
146	0.9744	0.0005	0.0000	0.0000	-2.7857	-3.8731	0.7962
147	0.9734	0.0003	0.0000	0.0000	-2.6678	-3.6113	0.2968
148	0.9813	-0.0022	0.0000	0.0000	-3.7539	-2.8257	-0.0703

149	0.9827	-0.0011	0.0000	0.0000	-4.4287	-2.5465	-0.8414
150	0.9826	-0.0027	0.0000	0.0000	-3.1124	-3.4088	-0.1825
151	0.9835	-0.0037	0.0000	0.0000	-2.1381	-4.2021	0.4002
152	0.9841	-0.0016	0.0000	0.0000	-2.7058	-4.3318	-1.1832
153	0.9759	0.0002	0.0000	0.0000	-3.3919	-3.3977	1.3856
154	0.9780	-0.0006	0.0000	0.0000	-4.3138	-2.5345	1.2656
155	0.9801	-0.0015	0.0000	0.0000	-4.2521	-2.2658	0.3515
156	0.9741	0.0022	0.0000	0.0000	-2.8812	-4.8005	1.8437
157	0.9813	-0.0047	0.0000	0.0000	-2.9988	-3.0015	0.3130
158	0.9801	-0.0053	0.0000	0.0000	-2.8850	-2.8145	0.1799
159	0.9801	-0.0039	0.0000	0.0000	-3.1046	-2.8757	0.2403
160	0.9788	-0.0055	0.0000	0.0000	-2.7484	-2.7231	0.0700
161	0.9790	-0.0044	0.0000	0.0000	-2.9046	-2.7893	0.1667
162	0.9788	-0.0032	0.0000	0.0000	-3.1457	-2.8259	0.3145
163	0.9794	-0.0061	0.0000	0.0000	-2.7337	-2.7195	0.0625
164	0.9751	-0.0018	0.0000	0.0000	-2.7590	-2.9912	0.2327
165	0.9775	-0.0026	0.0000	0.0000	-3.0710	-2.8701	0.3598
166	0.9761	-0.0023	0.0000	0.0000	-2.8769	-2.9200	0.2865
167	0.9781	-0.0049	0.0000	0.0000	-2.7398	-2.7159	0.0573
168	0.9777	-0.0040	0.0000	0.0000	-2.8352	-2.7698	0.1408
169	0.9767	-0.0034	0.0000	0.0000	-2.8071	-2.7796	0.1399

#### 4. - VISUALIZACION DE LOS DESPLAZAMIENTOS NODALES

##### ▣ CALCULO DE LOS VALORES MAXIMOS Y MINIMOS DE LOS DESPLAZAMIENTOS

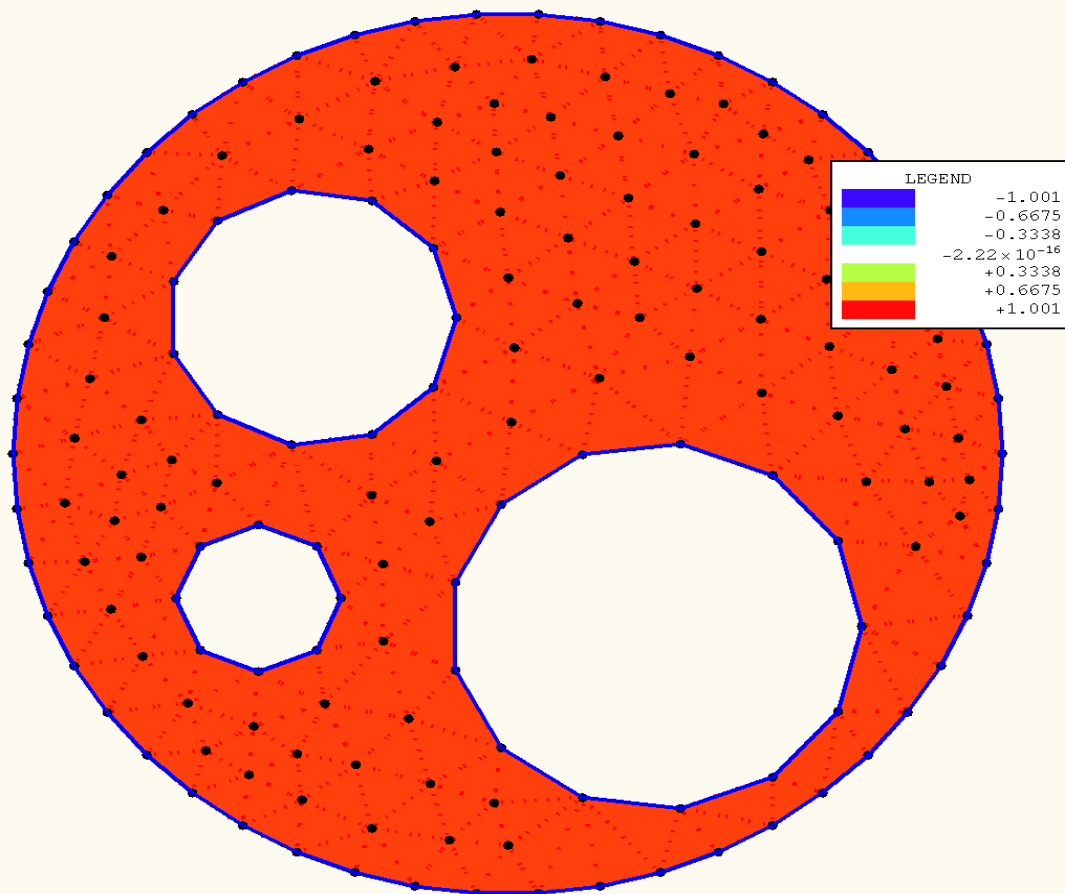
```
ueps = 10.^(-3); nbands = 10;
ux = Table[NodeDisplacements[[n, 1]], {n, numnod}];
uy = Table[NodeDisplacements[[n, 2]], {n, numnod}];
{uxmax, uymax} = Abs[{Max[ux], Max[uy]}] + ueps;
{uxmin, uymin} = Abs[{Min[ux], Min[uy]}] + ueps;
uxmax = Max[uxmax, uxmin]; uxmin = -uxmax;
uymax = Max[uymax, uymin]; uymin = -uymax;
{uxinc, uyinc} = {uxmax - uxmin, uymax - uymin} / nbands;
```

##### ▣ VISUALIZACION DESPLAZAMIENTOS NODALES - X e Y

```
Print["uxmin,uxmax,uxinc=", {uxmin, uxmax, uxinc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, ux, {uxmin, uxmax, uxinc},
{True, True, True, False, True, True}, {2, 2}, aspect, "Displacement component ux"];
```

```
uxmin,uxmax,uxinc={-1.00129, 1.00129, 0.200257}
```

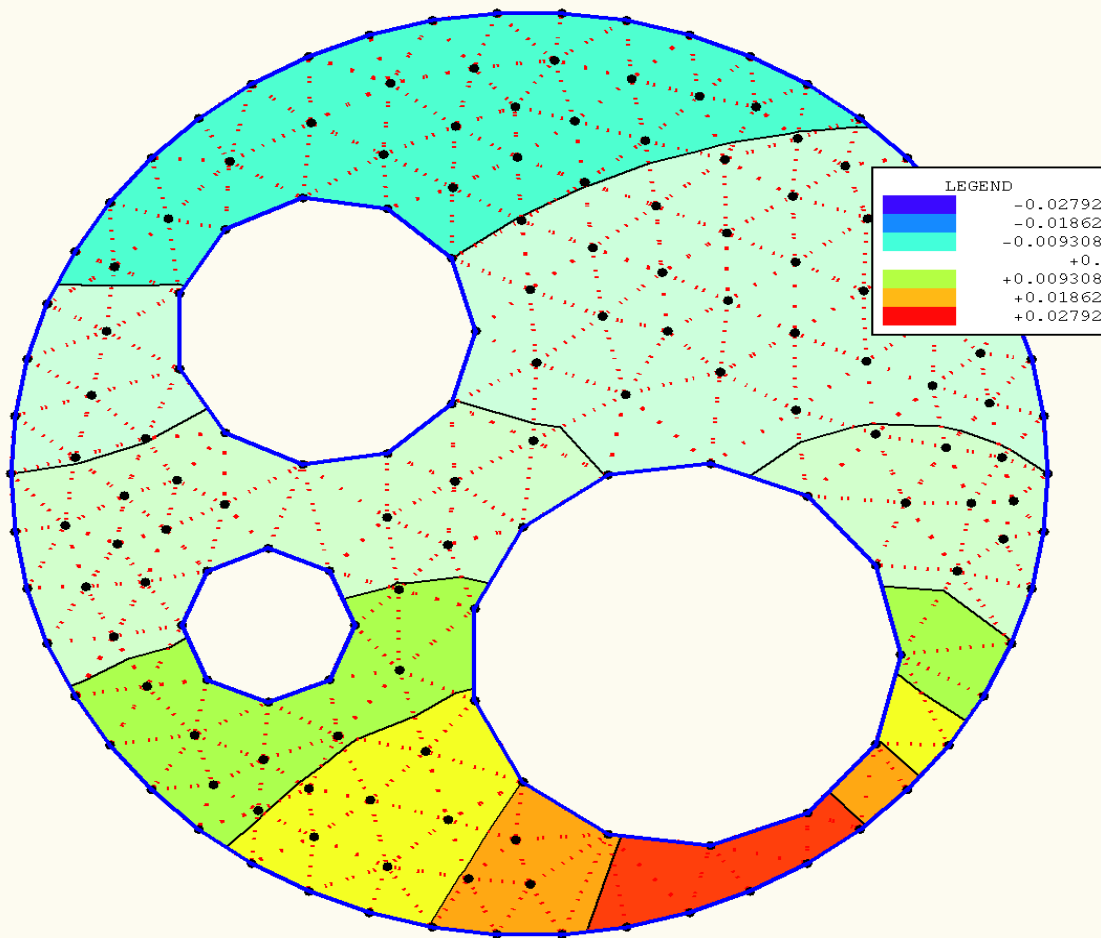
Displacement component ux



```
Print["uymin,uymax,uyinc=", {uymin, uymax, uyinc}];  
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, uy, {uymin, uymax, uyinc},  
{True, True, True, False, True, True}, {2, 2}, aspect, "Displacement component uy"];
```

```
uymin,uymax,uyinc={-0.0279241, 0.0279241, 0.00558482}
```

Displacement component uy



## 5. - VISUALIZACION DE LAS TENSIONES - NODALES - NORMALES Y TANGENCIALES

### □ CALCULO DE LAS TENSIONES PRINCIPALES Y DE VON MISES

```
sVM = sig1 = sig2 = tmax = Table[0, {numnod}];
For[n = 1, n <= numnod, n++,
  {sigxx, sigyy, sigxy} = NodePlateStresses[[n]]; s0 = (sigxx + sigyy) / 2;
  R = N[Sqrt[(sigxx - sigyy)^2 + sigxy^2]];
  sig1[[n]] = s0 + R; sig2[[n]] = s0 - R; tmax[[n]] = R;
  sVM[[n]] = N[Sqrt[3 * (sigxx^2 + sigyy^2 + sigxy^2) / 2]];
  Print["Max sig1,sig2,VM = ", {sg1max, sg2max, sVMmax}];
```

```
Max sig1,sig2,VM = {3.32776, 16.9691, 16.4354}
```



### □ CALCULO DE LOS VALORES MAXIMOS Y MINIMOS DE LAS TENSIONES NORMALES Y TANGENCIALES

```

aspect = 1;
sigeps = 10.^(-3); nbands = 10;
sxx = Table[NodePlateStresses[[n, 1]], {n, numnod}];
syy = Table[NodePlateStresses[[n, 2]], {n, numnod}];
sxy = Table[NodePlateStresses[[n, 3]], {n, numnod}];
{sxxmax, syymax, sxymin} = Abs[{Max[sxx], Max[syy], Max[sxy]}] + sigeps;
{sxxmin, syymn, sxymin} = Abs[{Min[sxx], Min[syy], Min[sxy]}] + sigeps;
sxxmax = Max[sxxmax, sxxmin]; sxxmin = -sxxmax;
syymax = Max[syymax, syymn]; syymn = -syymax;
sxymin = Max[sxymin, sxymin]; sxymin = -sxymin;
{sxxinc, syymn, sxyinc} = {sxxmax - sxxmin, syymax - syymn, sxymin - sxymin} / nbands;

```

### □ VISUALIZACION TENSIONES NODALES - NORMALES Y TANGENCIALES

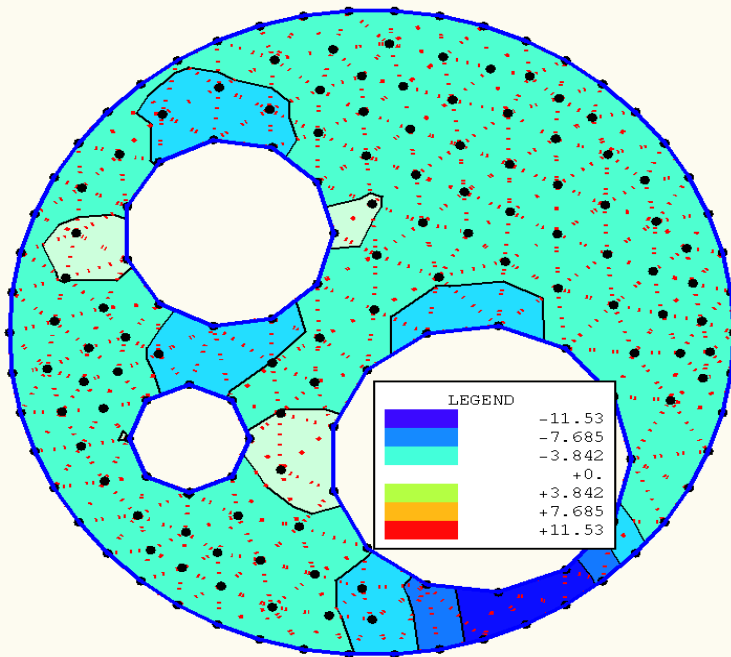
```

Print["sxxmin,sxxmax,sxxinc=", {sxxmin, sxxmax, sxxinc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, sxx, {sxxmin, sxxmax, sxxinc},
{True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Stress sigma-xx"];

```

```
sxxmin,sxxmax,sxxinc={-11.5273, 11.5273, 2.30546}
```

Stress sigma-xx



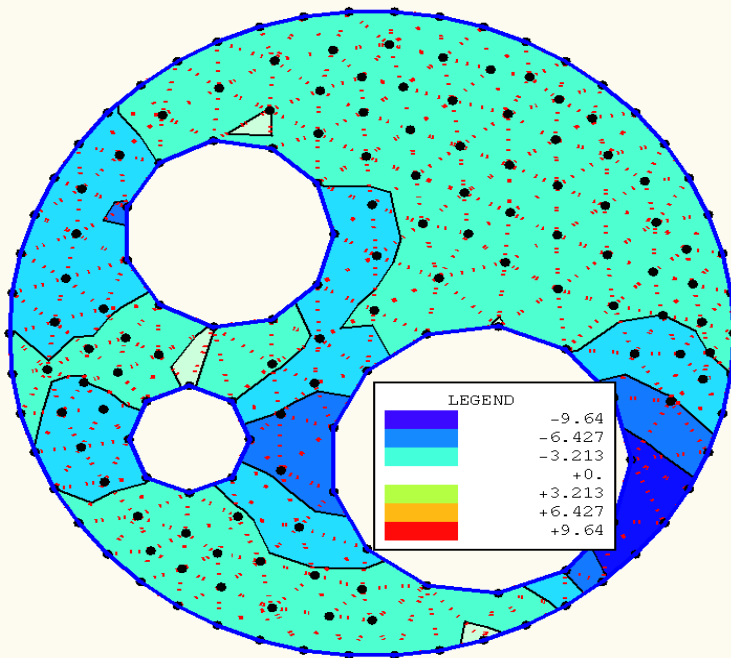
```

Print["syymn,syymax,syymn=", {syymn, syymax, syymn}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, syy, {syymn, syymax, syymn},
{True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Stress sigma-yy"];

```

```
syymin,syymax,syyinc={-9.64045, 9.64045, 1.92809}
```

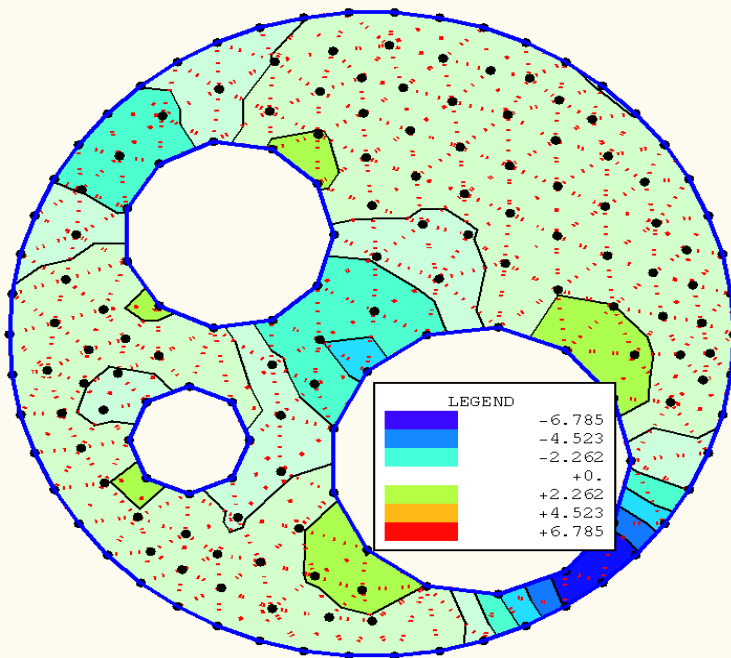
Stress sigma-yy



```
Print["sxymin,sxmax,sxyinc=", {sxymin, sxymax, sxyinc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, sxy, {sxymin, sxymax, sxyinc},
{True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Stress sigma-xy"];
```

```
sxymin,sxmax,sxyinc={-6.78521, 6.78521, 1.35704}
```

Stress sigma-xy



#### □ CALCULO DE LAS TENSIONES PRINCIPALES Y DE VON MISES

```
sVM = sig1 = sig2 = Table[0, {numnod}];
For[n = 1, n <= numnod, n++,
  {sigxx, sigyy, sigxy} = NodePlateStresses[[n]]; s0 = (sigxx + sigyy) / 2;
  R = N[Sqrt[(sigxx - sigyy)^2 + sigxy^2]];
  sig1[[n]] = s0 + R; sig2[[n]] = s0 - R; tmax[[n]] = R;
  sVM[[n]] = N[Sqrt[3 * (sigxx^2 + sigyy^2 + sigxy^2) / 2]]];
```

#### □ CALCULO DE LOS VALORES MAXIMOS Y MINIMOS DE LAS TENSIONES PRINCIPALES Y DE VON MISES

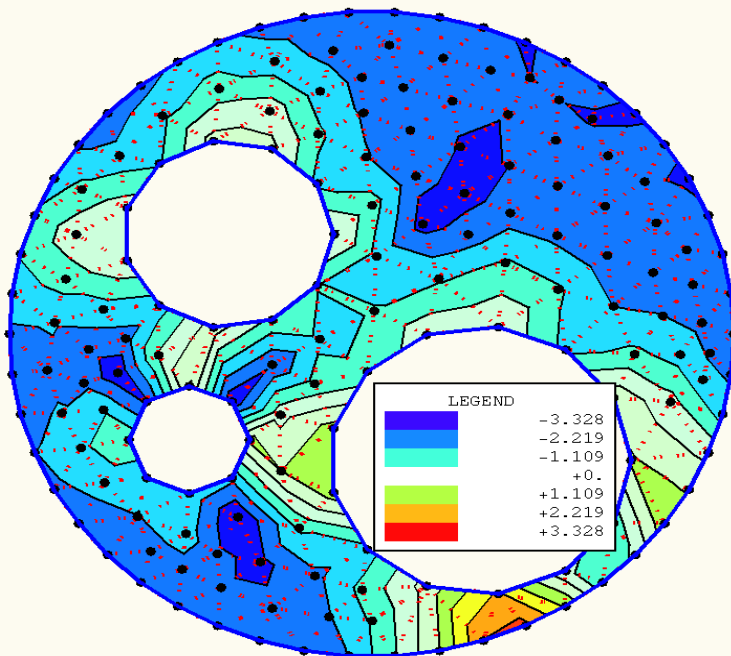
```
{sg1max, sg2max, sVMmax} = Abs[{Max[sig1], Max[sig2], Max[sVM]}] + sigeps;
{sg1min, sg2min, sVMmin} = Abs[{Min[sig1], Min[sig2], Min[sVM]}] + sigeps;
sg1max = Max[sg1max, sg1min]; sg1min = -sg1max;
sg2max = Max[sg2max, sg2min]; sg2min = -sg2max;
sVMmax = Max[sVMmax, sVMmin]; sVMmin = -sVMmax;
{sg1inc, sg2inc, sVMinc} = {sg1max - sg1min, sg2max - sg2min, sVMmax - sVMmin} / nbands;
```

#### □ VISUALIZACION TENSIONES NODALES - PRINCIPALES Y DE VON MISES

```
Print["sg1min,sg1max,sg1inc=", {sg1min, sg1max, sg1inc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, sig1, {sg1min, sg1max, sg1inc},
  {True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Max principal stress sig1"];
```

```
sg1min,sg1max,sg1inc={-3.32776, 3.32776, 0.665552}
```

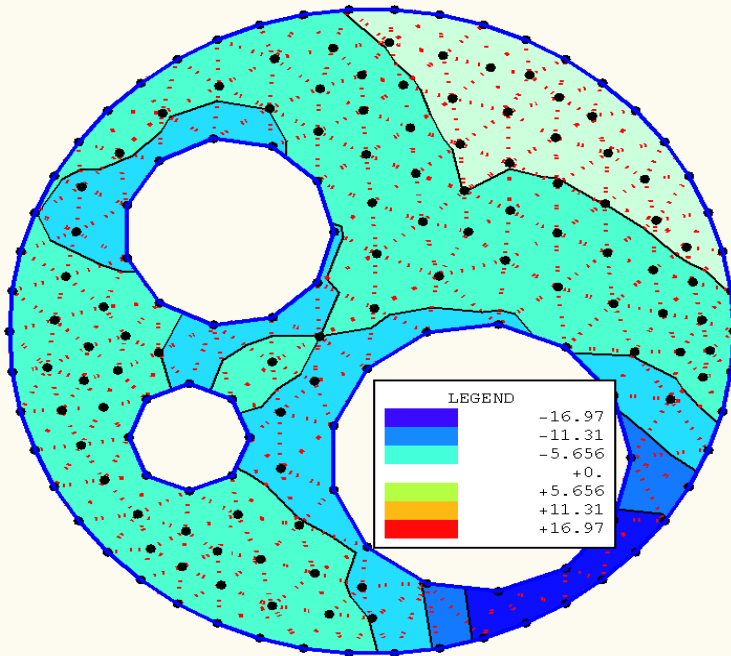
Max principal stress sig1



```
Print["sg2min,sg2max,sg2inc=", {sg2min, sg2max, sg2inc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, sig2, {sg2min, sg2max, sg2inc},
  {True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Min principal stress sig2"];
```

```
sg2min,sg2max,sg2inc={-16.9691, 16.9691, 3.39382}
```

Min principal stress sig2



```
Print["sVMmin,sVMmax,sVMinc=", {sVMmin, sVMmax, sVMinc}];
ContourBandPlotNodeFuncOver2DMesh[NodeCoordinates, ElemNodes, sVM, {sVMmin, sVMmax, sVMinc},
{True, True, True, False, True, True}, {0.2, -0.5}, aspect, "Von Mises stress"];
```

```
sVMmin,sVMmax,sVMinc={-16.4354, 16.4354, 3.28708}
```

Von Mises stress

