

Title: Crack Propagation in a Corner Bracket

Subtitle: ANSYS APDL

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Code is available on: <https://github.com/MikulaJakub/crack-growth-using-ANSYS-APDL>.

This post provides another example on the modelling of crack growth in ANSYS APDL described in the previous post.

<https://www.youtube.com/watch?v=eyI2GIwjHHQ>

1 Demonstration

1.1 Geometry

The interest of this analysis is in the effect of the middle hole size on the crack path that is assumed to initiate from point A under $\theta = 45^\circ$ with respect to the global coordinate system.

The geometry of this sample and the initial mesh is shown in the following figures.

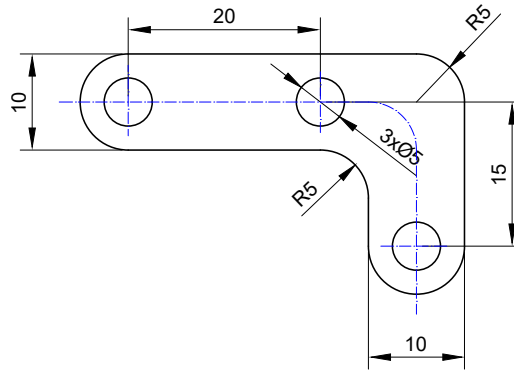


Figure 1: Geometry drawing.

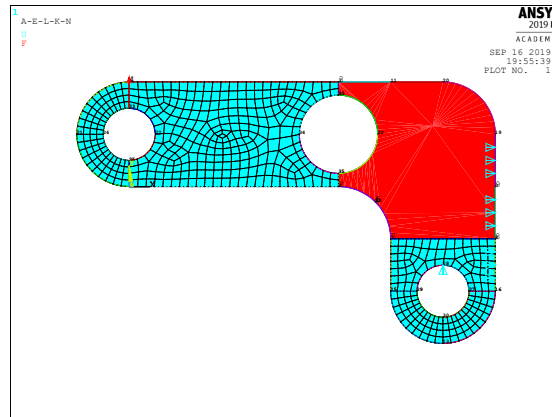


Figure 2: Initial geometry.

The geometry can be generated using the following macro:

Listing 1: Macro to generate CT sample geometry

```
1 FINISH
2 /clear
3 /prep7
```

```

4
5 T1 = 10
6 T2 = 10
7 D1 = 5
8 D2 = 5
9 D3 = 5
10 L1 = 20
11 L2 = 5
12 R = 5
13
14 k
15 k,,L1
16 k,,L1,T1
17 k,,,T1
18
19 l,1,2
20 l,2,3
21 l,3,4
22 l,4,1
23
24
25 k,,L1
26 k,,L1+R
27 k,,L1+R,-R
28 k,,L1+R+T2,-R
29 k,,L1+R+T2
30 k,,L1+R+T2,T1
31 k,,L1+R,T1
32 k,,L1,T1
33
34 l,2,6
35 l,6,11
36 l,11,12
37 l,12,2
38
39
40 l,6,7
41 l,7,8
42 l,8,9
43 l,9,6
44
45
46 l,6,9
47 l,9,10
48 l,10,11
49 l,11,6
50
51
52 k,, -R
53 k,, -R,T1
54
55 l,1,13
56 l,13,14
57 l,14,4
58
59 k,,L1+R,-R-L2
60 k,,L1+R+T2,-R-L2
61
62 k,,L1+R,-R-L2-R
63 k,,L1+R+T2,-R-L2-R
64
65 l,7,15
66 l,15,16

```

```

67 1,16,8
68
69 1,15,17
70 1,17,18
71 1,18,16
72
73 LFILLT,5,9,R, ,
74 LFILLT,13,14,R, ,
75 LFILLT,17,16,R, ,
76 LFILLT,15,16,R, ,
77 LFILLT,21,22,R, ,
78 LFILLT,22,23,R, ,
79
80 k,,,T1/2
81 circle,18,D1/2
82 k,,L1+R+T2/2,-R-L2
83 circle,26,D2/2
84
85 ldelete,6
86 ldelete,12
87
88 k,,L1,T1/2
89 circle,31,D3/2
90
91 LPTN,ALL
92 al,32,17,9,36,22,23
93 al,1,33,30,12,35,3,36,21,25,32
94
95 LSEL,S, , ,24
96 LSEL,A, , ,10
97 LSEL,A, , ,11
98 LSEL,A, , ,13
99 LSEL,A, , ,5
100 LSEL,A, , ,14
101 LSEL,A, , ,34
102 LSEL,A, , ,35
103 LSEL,A, , ,6
104 LSEL,A, , ,31
105 LSEL,A, , ,33
106
107 al,all
108
109 allsel,all
110 al,18,37,27,26,38,20,10
111 al,37,15,16,38,29,28
112
113 APTN,ALL
114
115 ! finite element
116 ET,1,82
117 KEYOPT,1,3,2 !plane strain conditions
118
119 ! isotropic elasticity
120 MP,EX,1,210000
121 MP,PRXY,1,0.3
122
123 LCCAT,17,9
124 LCCAT,22,23
125 LCCAT,15,16
126 LCCAT,28,29
127
128 LSEL,S,,,36
129 LSEL,A,,,21

```

```

130 LSEL,A,,,25
131 LSEL,A,,,32
132 LCCAT,ALL
133 allsel,all
134
135 LSEL,S,,,35
136 LSEL,A,,,12
137 LSEL,A,,,30
138 LSEL,A,,,33
139 LCCAT,ALL
140 allsel, all
141
142 LSEL,S,,,37
143 LSEL,A,,,27
144 LSEL,A,,,26
145 LSEL,A,,,38
146 LCCAT,ALL
147 allsel, all
148
149
150 ESIZE,0.8,0,
151 MSHAPE,0,2D
152 MSHKEY,1
153 AMESH,1
154 AMESH,5
155
156 MSHKEY,0
157 AMESH,2
158 AMESH,4
159
160 FK,23,FY,100 !100 N force
161 DK,28,,,,0,UY
162
163 DL,13, ,UX,
164 DL,11, ,UX,
165 DL,20, ,UX,
166
167 LDIV,      24,   0.5
168
169 ldele,39
170 ldele,40
171 ldele,41
172
173 LSEL,R,LCCA
174 LDELE,ALL
175 allsel,all
176
177 kdele,14
178 kdele,18
179 kdele,31
180 kdele,5
181 kdele,6
182 kdele,17
183 kdele,26
184 kdele,10
185
186 LDIV,      44,   0.01
187 LDIV,      24,   0.99

```

1.2 Results

Interestingly, the crack propagates toward the hole, and for the case when $d = 7.4\text{mm}$ the crack gets arrested within the hole. Designing structural features such as holes may improve the lifetime of the system by arresting the existing crack.