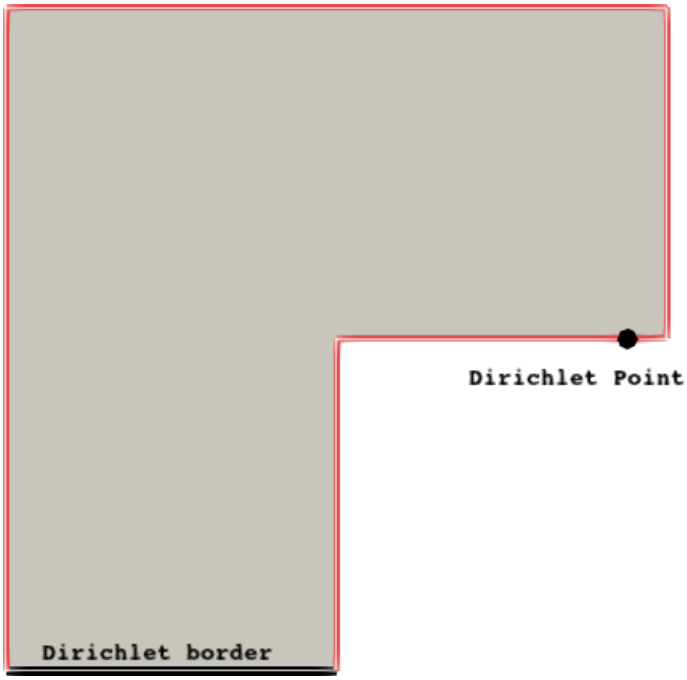
L-shape cracking

This tutorial involves cracking of L shaped specimen, where loading is controlled by a point boundary condition.



Preprocessing

You can either solver the problem using vectorial approach (recommended) or using staggered approach. To generate the solver use either from below.

- Generation of solver (vectorial)

```
PSD_PreProcess -dimension 2 -problem damage -model hybrid-phase-field \
-dirichletconditions 1 -dirichletpointconditions 1 -debug -postprocess ud \
-energydecomp -constrainHPF -vectorial -getreactionforce -plotreactionforce \
-reactionforce variational-based
```

- Generating solver (staggered)

```
PSD_PreProcess -dimension 2 -problem damage -model hybrid-phase-field \
-dirichletconditions 1 -dirichletpointconditions 1 -debug -postprocess ud \
-energydecomp -constrainHPF -getreactionforce -plotreactionforce \
-reactionforce variational-based
```

Edit Cycle

Edit ControlParameter.edp:

- Update physical parameter, change

```
  real lambda = 121.15e3 ,
       mu     = 80.77e3  ,
       Gc     = 2.7      ;
```

to

```
real    lambda  = 6.16e3 ,
        mu      = 10.95e3 ,
        Gc      = 8.9e-2 ;
```

- Update solver parameter , change

```
  real lfac  = 2.0  ,
       maxtr = 7e-3 ,
       tr    = 1e-5 ,
       dtr   = 1e-5 ,
       lo           ;
```

to

```
real    lfac    = 2.0   ,
        maxtr   = 1     ,
        tr      = 1e-2  ,
        dtr     = 1e-2  ,
        lo              ;
```

- Enter the correct Point boundary condition, change

```
  real[int,int] PbcCord = [
//-------------------- [  x  , y  ] --------------------//
                       [  0. , 0. ]    // point 0
//-----------------------------------------------------//
                     ];

   macro Pbc0Ux  -0. //
   macro Pbc0Uy  -0. //
```

to

```
  real[int,int] PbcCord = [
//-------------------- [  x  , y  ] --------------------//
                       [  470., 250. ]    // point 0
//-----------------------------------------------------//
                     ];

   macro Pbc0Uy  tr //
```

Edit LinearFormBuilderAndSolver.edp:

- To postprocess correct reaction forces in LinearFormBuilderAndSolver.edp for vectorial solver, change

```
for(int i=0; i < Th.nv; i++){
   if(abs(Th(i).y-1.)<.000001){
      forcetotx = forcetotx + F[][i*3]*DP[i*3];
      forcetoty = forcetoty + F[][i*3+1]*DP[i*3+1];
   }
}
```

to

```
if(mpirank==mpirankPCi[0]){
   forcetotx = forcetotx + F[][PCi[0]*3+0]*DP[PCi[0]*3+0];
   forcetoty = forcetoty + F[][PCi[0]*3+1]*DP[PCi[0]*3+1];
}
```

- To postprocess correct reaction forces in LinearFormBuilderAndSolver.edp for staggered solver, change

```
for(int i=0; i < Th.nv; i++){
   if(abs(Th(i).y-1.)<.000001){
      forcetotx = forcetotx + F[][i*2]*DP[i*2];
      forcetoty = forcetoty + F[][i*2+1]*DP[i*2+1];
   }
}
```

to

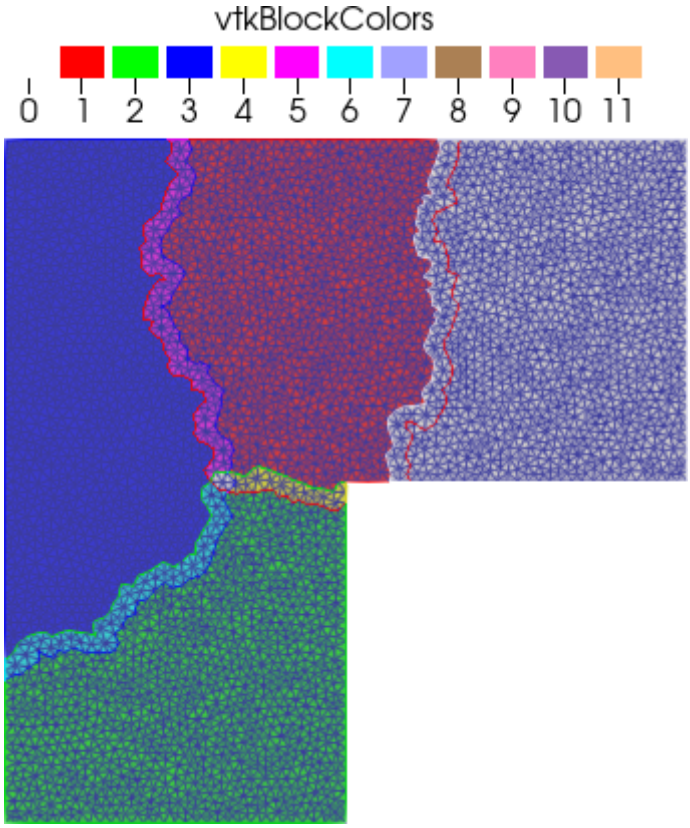
```
if(mpirank==mpirankPCi[0]){
   forcetotx = forcetotx + F[][PCi[0]*2+0]*DP[PCi[0]*2+0];
   forcetoty = forcetoty + F[][PCi[0]*2+1]*DP[PCi[0]*2+1];
}
```

- Finally to include cyclic loading, change

```
//-----------------updating traction---------------//

tr += dtr;
```

to

```
//-----------------updating traction---------------//

if(iterout<50)

   tr += dtr;
if(iterout>=51 && iterout<110)
   tr -= dtr;
if(iterout>=111)
   tr += dtr;
```

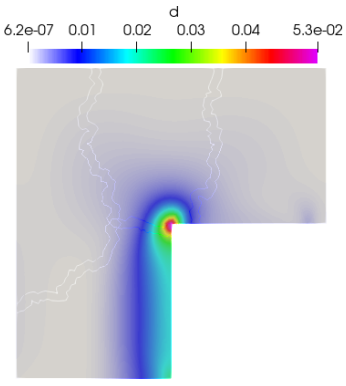
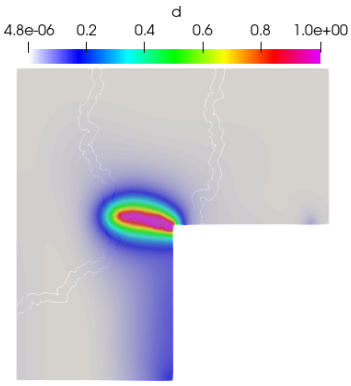
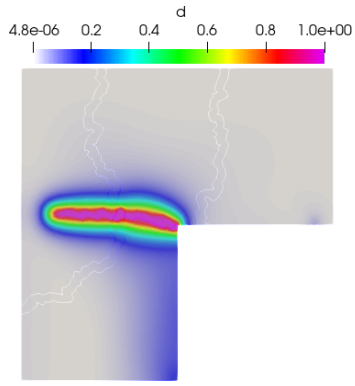


Solving

```
PSD_Solve -np 4 Main.edp -wg -v 0 -mesh ./../Meshes/2D/L-shaped-crack.msh
```

Postprocessing

Use ParaView to post process results.

Crack initiating	Crack moving	Crack developed
		

On you screen, the force displacement curve which plots (force.data) should look something like this

Force-displacement curve with cyclic loading