L-shape cracking

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

Preprocessing

Generation of solver

```
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
```

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 VariationalFormulation.edp:

- Remove the pre-cracked Dirichlet from VariationalFormulation, delete these lines

```
    //-------------------------------------------------------------------------

    //  $\forall x\in\partial\Omega_D u=ug: ug\to\mathbb R$

    //-------------------------------------------------------------------------

    + on(4,u2 = 1)                          // Cracked (Dirichlet)
```

Edit LinearFormBuilderAndSolver.edp:

- To postprocess correct reaction forces in LinearFormBuilderAndSolver.edp, 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

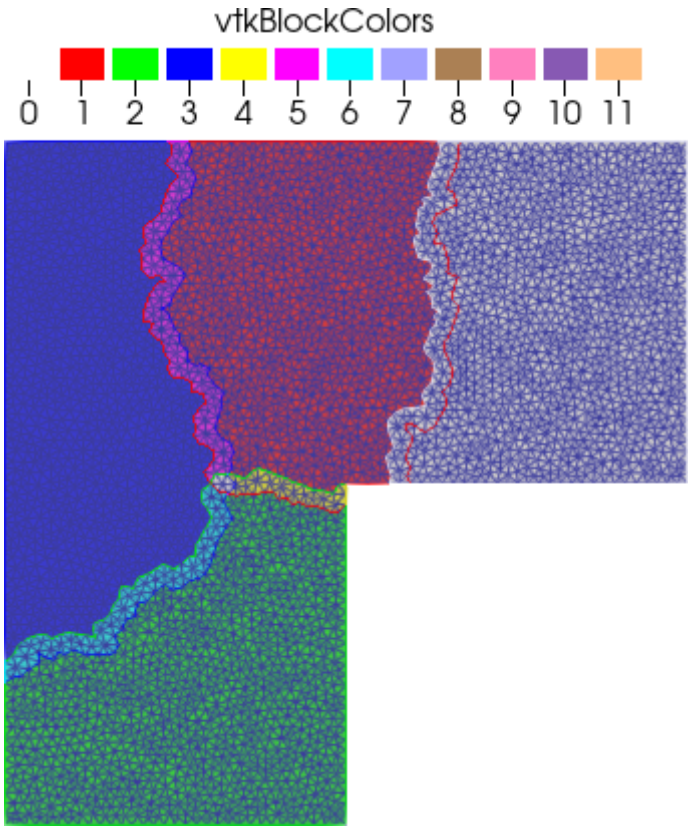
```
  if(mpirank==mpirankPCi[0]){
     forcetotx = forcetotx + F[][PCi[0]*3+0]*DP[PCi[0]*3+0];
     forcetoty = forcetoty + F[][PCi[0]*3+1]*DP[PCi[0]*3+1];
  }
```

- Finally to include cyclic loading, change

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

  tr += dtr;
```

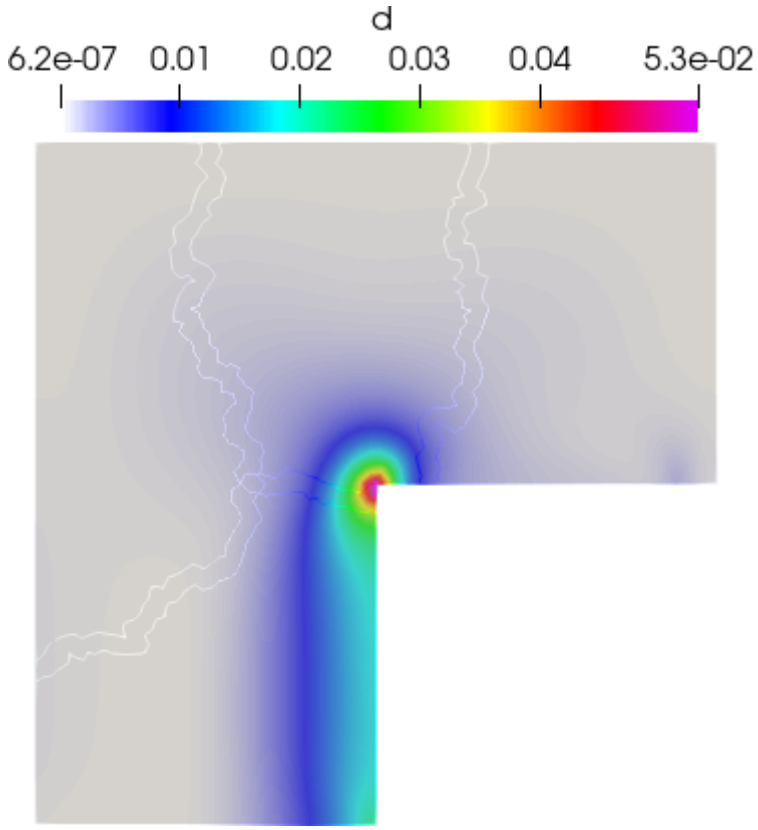
to

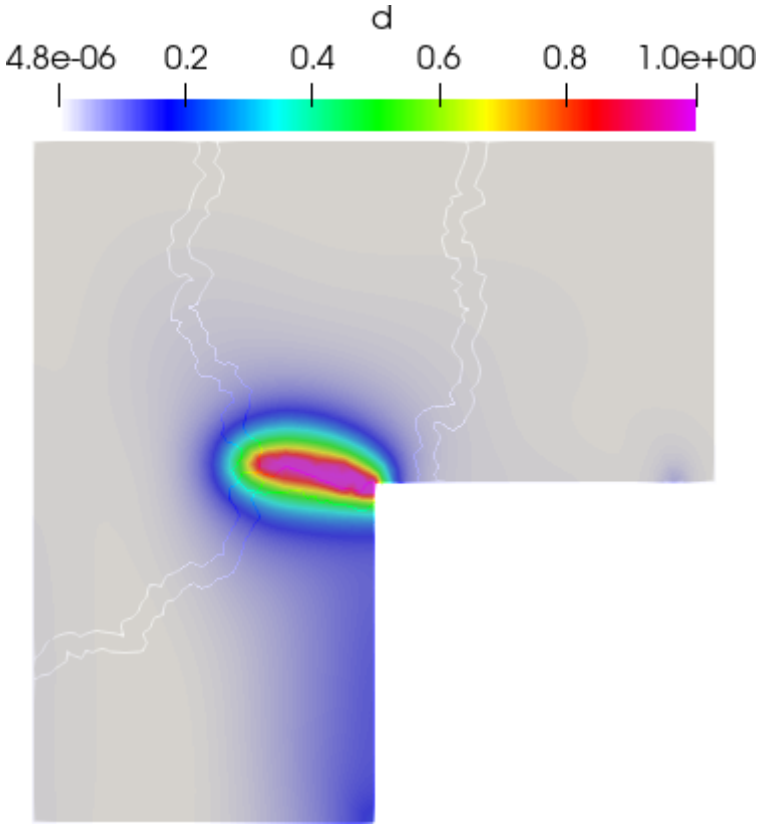
```
   //-----------------updating traction----------------//

   if(iterout<50)

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

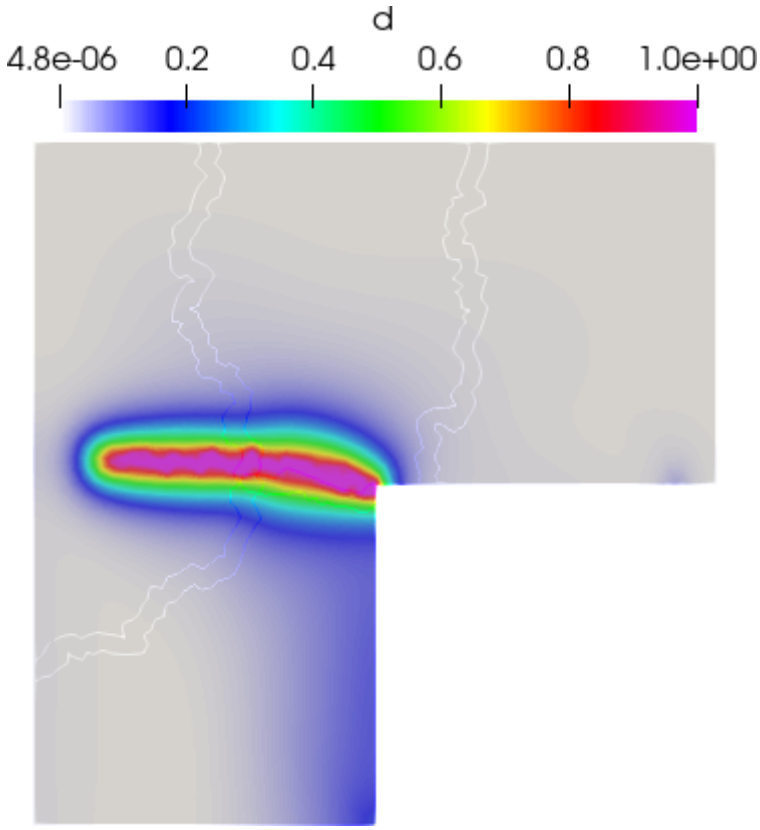


Solving

```
PSD_Solve -np 4 Main.edp -wg -v 0 -mesh ./../../Meshes/2D/L-shaped-crack.msh -v 0
-ksp_rtol 1e-6 -split 1
```


d
6.2e-07
0.01
0.02
0.03
0.04
5.3e-02


d
4.8e-06
0.2
0.4
0.6
0.8
1.0e+00


d
4.8e-06
0.2
0.4
0.6
0.8
1.0e+00