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; cav.dat
; Undrained cylindrical cavity expansion in Cam-Clay medium
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title
    Undrained cylindrical cavity expansion in Cam-Clay medium
config fluid
; --- model geometry ---
gen zone brick p0 1.0      0.0      1.0    p1 200.0      0.0      1.0    &
                p2 1.0      0.0      0.0    p4 200.0      0.0      0.0    &
                p3 0.9877  0.1564    1.0    p6 197.5377  31.2869    1.0    &
                p5 0.9877  0.1564    0.0    p7 197.5377  31.2869    0.0    &
                size 31 1 1 ratio 1.1 1 1
def find_id
    pnt1 = gp_near(1., 0., 1.)
    pnt2 = gp_near(1., 0., 0.)
    pnt3 = gp_near(0.9877, 0.1564, 1.)
    pnt4 = gp_near(0.9877, 0.1564, 0.)
    id1  = gp_id(pnt1)
    id2  = gp_id(pnt2)
    id3  = gp_id(pnt3)
    id4  = gp_id(pnt4)
    pntz = z_near(1., 0.07, 0.5)
    cc   = cos(4.5*degrad)
    ss   = sin(4.5*degrad)
    sc   = 2.*cc*ss
    cc   = cc*cc
    ss   = ss*ss
    b_vel= 1.e-5
    b_vx = 0.9877*b_vel
    b_vy = 0.1564*b_vel
end
find_id
range name out cyl end1 0 0 -10 end2 0 0 10 rad 197.5377 not
range name in  cyl end1 0 0 -10 end2 0 0 10 rad 1.001
; --- model properties ---
mo cam-clay
prop shear 74.
prop mm 1.2 lambda 0.15 kappa 0.03 mpl 1.0 mv_1 2.3
mo fl_iso
; --- boundary conditions ---
fix y z range y -.001 .001
apply nvel 0.0 plane dip 90.0 dd -9.0 origin 0.0 0.0 0.0 &
    range in not y 0.07 200.0

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apply dvel 0.0 plane dip 90.0 dd -9.0 origin 0.0 0.0 0.0 &
  range in not y 0.07 200.0
apply nstress -1.65 range out
fix x y z range in
ini xvel b_vel range id id1 id1
ini xvel b_vel range id id2 id2
ini xvel b_vx yvel b_vy range id id3 id3
ini xvel b_vx yvel b_vy range id id4 id4
ini sxx -1.65 syy -1.65 szz -3.
; model settings ---
set fluid biot on
set fluid off
set large
; --- fish functions ---
; ... initial specific volume, tangent bulk modulus, porosity ...
def set_prop
  pnt = zone_head
  s1 = -z_sxx(pnt)
  s2 = -z_syy(pnt)
  s3 = -z_szz(pnt)
  p0 = (s1 + s2 + s3) / 3.
  q0 = sqrt(((s1-s2)*(s1-s2)+(s2-s3)*(s2-s3)+(s3-s1)*(s3-s1))*0.5)
  e0 = q0 / (z_prop(pnt,'mm') * p0)
  pc = p0 * (1. + e0 * e0)
  pl = z_prop(pnt,'mpl')
  vc = z_prop(pnt,'mv_l') - z_prop(pnt,'lambda') * ln(pc/pl)
  v0 = vc - z_prop(pnt,'kappa') * ln(p0/pc)
  b0 = v0 * p0 / z_prop(pnt,'kappa')
  n0 = (v0 - 1.) / v0
  bb = 10. * b0
  bi = 100. * b0
  command
    prop mpc pc bulk_bound bb
    ini biot_mod bi
  end_command
end
; ... numerical variables ...
def path
  srad = z_sxx(pntz)*cc+z_syy(pntz)*ss+z_sxy(pntz)*sc
  p_fl = z_pp(pntz)
  c_tp = -(z_sxx(pntz)+z_syy(pntz)+z_szz(pntz)) / 3.
  c_ep = z_prop(pntz,'cp')
  c_q = z_prop(pntz,'cq')
  c_cq = c_ep * z_prop(pntz,'mm')

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    c_v = z_prop(pntz,'cv')
    c_a = 1. + gp_xdisp(pnt2)
    c_b = z_prop(pntz,'bulk')
    c_pc = z_prop(pntz,'mpc')
end
; --- histories ---
hist nstep 500
hist path
hist srاد
hist p_fl
hist c_a
hist c_ep
hist c_cq
hist c_tp
hist c_v
hist c_q
hist c_b
hist c_pc
hist unbal
; --- test ---
set_prop
step 100000
save cav.sav

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