Ex.1) Simple test by 1 Solid Element

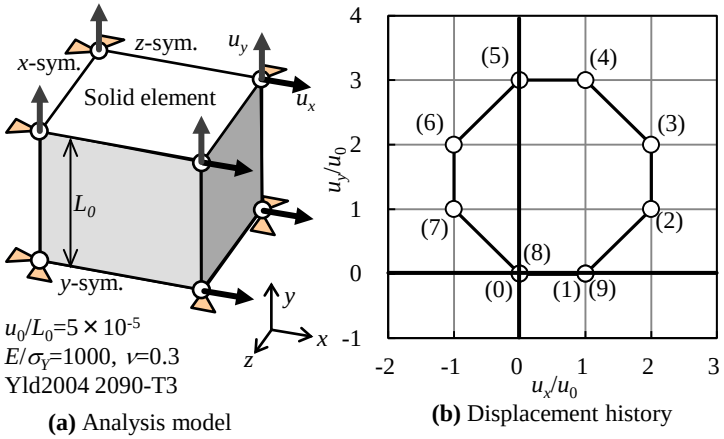


Figure. Analysis condition for simple verification test.

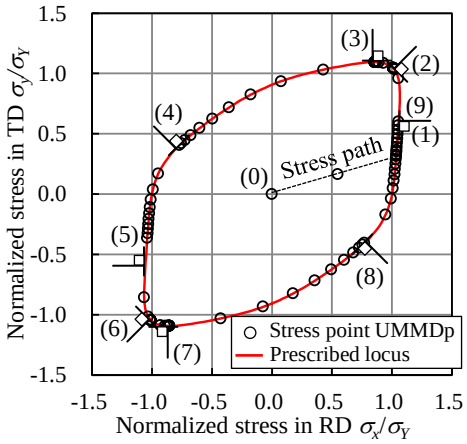
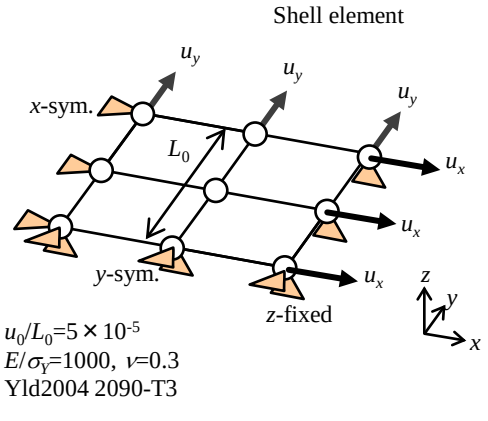


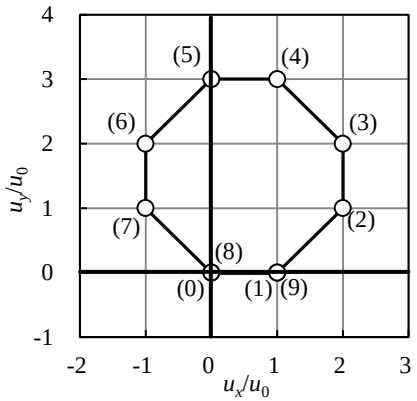
Figure. Verification of UMMDp

```
Yld2004(18p) Yield Function Data
 c'12      c'13      c'21      c'23      c'31      c'32
-0.069888, 0.936408, 0.079143, 1.00306,  0.524741, 1.363180
 c'44      c'55      c'66
 0.954322, 1.023770, 1.069060
 c"12      c"13      c"21      c"23      c"31      c"32
 0.981171, 0.476741, 0.575316, 0.866827, 1.145010,-0.079294
 c"44      c"55      c"66      M
 1.404620, 1.051660, 1.147100, 8.0
```

Ex.2) Simple test by 4 Shell Elements



(a) Analysis model

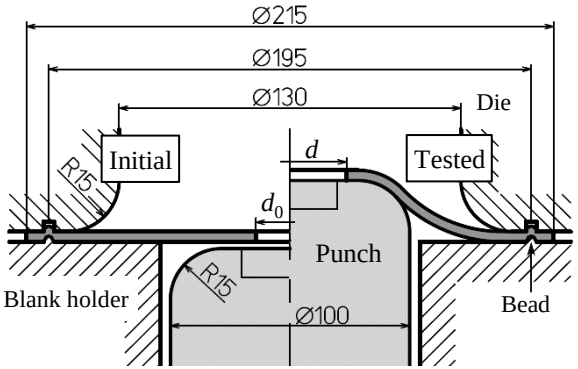


(b) Displacement history

Figure. Analysis condition for simple verification test.

```
Yld2004(18p) Yield Function Data
 c'12      c'13      c'21      c'23      c'31      c'32
-0.069888, 0.936408, 0.079143, 1.00306,  0.524741, 1.363180
 c'44      c'55      c'66
 0.954322, 1.023770, 1.069060
 c"12      c"13      c"21      c"23      c"31      c"32
 0.981171, 0.476741, 0.575316, 0.866827, 1.145010,-0.079294
 c"44      c"55      c"66      M
 1.404620, 1.051660, 1.147100, 8.0
```

Ex.3) The Hole Expansion test by shell elements



Material	SPCD (JIS G3141)
Thickness	0.65mm
Young's modulus	E=200GPa
Poisson's ratio	ν=0.3
Hardening curve	$\sigma_Y = 541(p+0.004)^{0.25}$ MPa

Figure. The experimental set-up for the hole expansion test and material properties.

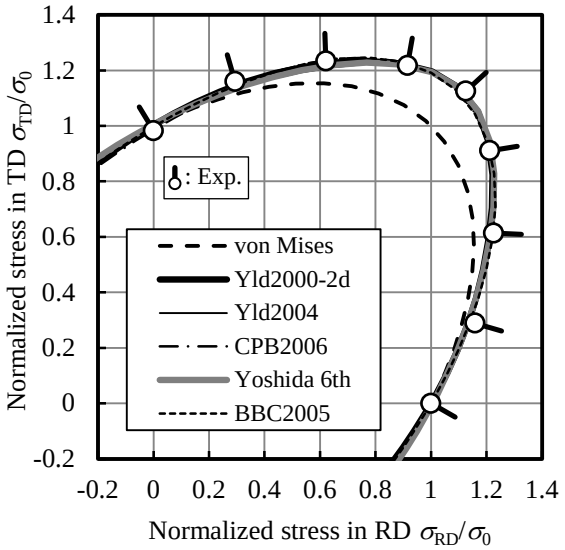
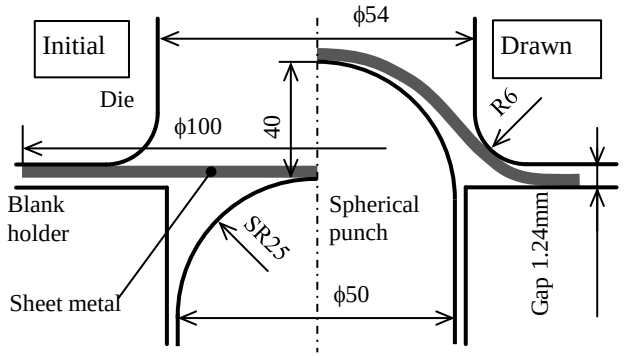


Figure. Yield loci with experimental plots.

```
Yld2004(18p) Yield Function Data
c'12      c'13      c'21      c'23      c'31      c'32
0.802064,-0.371744, 1.730877, 0.111897, 1.786988, 1.759011
c'44      c'55      c'66
1.514999, 1.000000, 1.000000
c"12      c"13      c"21      c"23      c"31      c"32
0.149032, 0.137615, 0.843118,-1.095887, 1.450332, 1.897261
c"44      c"55      c"66      M
-0.011837 1.000000, 1.000000, 2.845500
```

Ex.4) The Deep Drawing with Spherical Punch



Material AA5182-O, t_0=1.00mm
Elastic properties E=69.2GPa, ν=0.33
Hardening curve $\sigma_Y = 315 - 189e^{-13.1p} + 221p$ MPa

Figure. The set-up for deep-drawing with spherical punch.

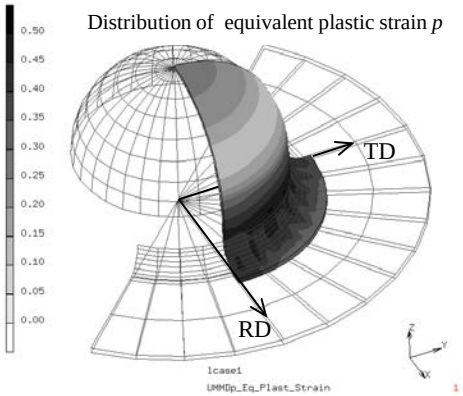


Figure. Example of analysis result

```
Yld2004(18p) Yield Function Data
c'12      c'13      c'21      c'23      c'31      c'32
0.567726, 1.011906, 0.918738, 0.949253, 0.804483, 0.541426
c'44      c'55      c'66
0.641800, 1.000000, 1.000000,
c"12      c"13      c"21      c"23      c"31      c"32
0.881539, 1.281299, 1.468511, 1.694334, 0.874666, 0.56210
c"44      c"55      c"66      M
1.275310, 1.000000, 1.000000  6.565182
```