INITSTATE EXAMPLE

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INITIAL STATE

- This example is originated from a thermal-structural analysis

- One reason for performing a thermal-structural study of the welding process is to evaluate the residual stress field.

- Recall that residual stresses are summed to the operational stresses.

$$\sigma_{TOTAL} = \sigma_{DESIGN} + \sigma_{RESIDUAL}$$

- Since the thermal-structural study can be computationally very complex (large files), an efficient approach is to write a special initial state file, that can be read on other simulations.

INITIAL STATE

- The first step is to create an initial state file (*.ist) to be read.
  - File can be manually by the user

```
/CSYS,0
! ELEM ID   ELEM INTG   LAY/CELL   SECT INTG    SX      SY      SZ      SXY      SYZ      SXZ
     1 ,      1,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      2,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      3,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      4,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      5,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      6,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      7,           ,          ,        100,      0,      0,      0,       0,       0
     1 ,      8,           ,          ,        100,      0,      0,      0,       0,       0
```

  - File can be automatically written by ANSYS, using the INISTATE command (shown next).

- The automatic creation is recommended, since it provides more precise results, but a file can be manually created if a previous simulation is not available.

INITIAL STATE

- **INISTATE** command sintax for creation of files.

INISTATE, WRITE, 1, , , , *CSID*, *Dtype*

- **CSID** defines reference coordinate system for results.
  - 0 : uses the Global Cartesian System
  - -1 or MAT : based on material coordinate system
  - -2 or ELEM : based on element's coordinate system
- **Dtype** defines which result will be written.
  - S : output stresses
  - EPEL : output elastic strain
  - EPPL : output plastic strain

INITIAL STATE

- **INISTATE** is used again for reading the initial state file.

INISTATE, READ, *Fname*, *Ext*

- In WorkBench, initial state file has the file.ist default name.
- The same procedure for copying results files in submodeling and thermal-structural simulations can be used.

/COPY, file, ist, , file, ist, ..\..

Use this at the initial state model, at the Solution folder

/COPY, file, ist, ..\..\, file, ist

Use this at the main model, at the Environment folder

INITIAL STATE

- If a reference analysis is unavailable, initial state can be entered directly by two **INISTATE** instructions.

INISTATE, SET, DTYP, *Data Type*
INISTATE, DEFINE, *Elid*, *Eint*, *Klayer*, *ParmInt*, *Cxx*, *Cyy*, *Czz*, *Cxy*, *Cyz*, *Cxz*

Data Type is the type of result (as the previous labels shown)

Elid is the element number (ALL can be used)

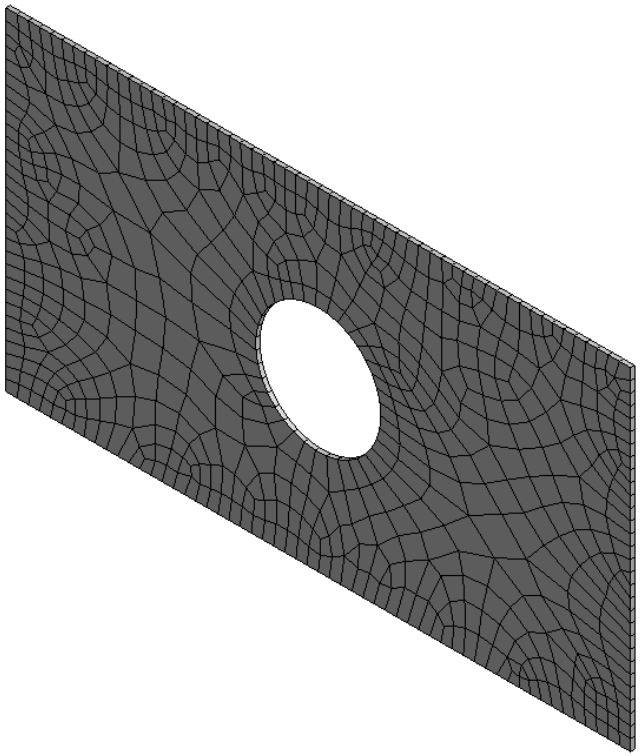
Elint is the Gauss integration point

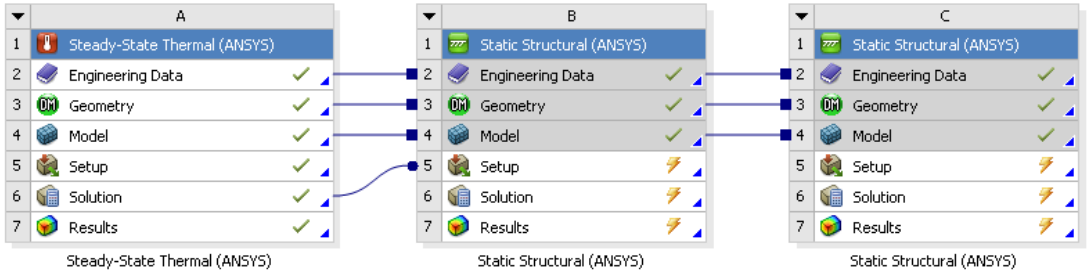
ParmInt is the section integration point for shells and beams

Cxx ... Cxz are the component values

INITIAL STATE

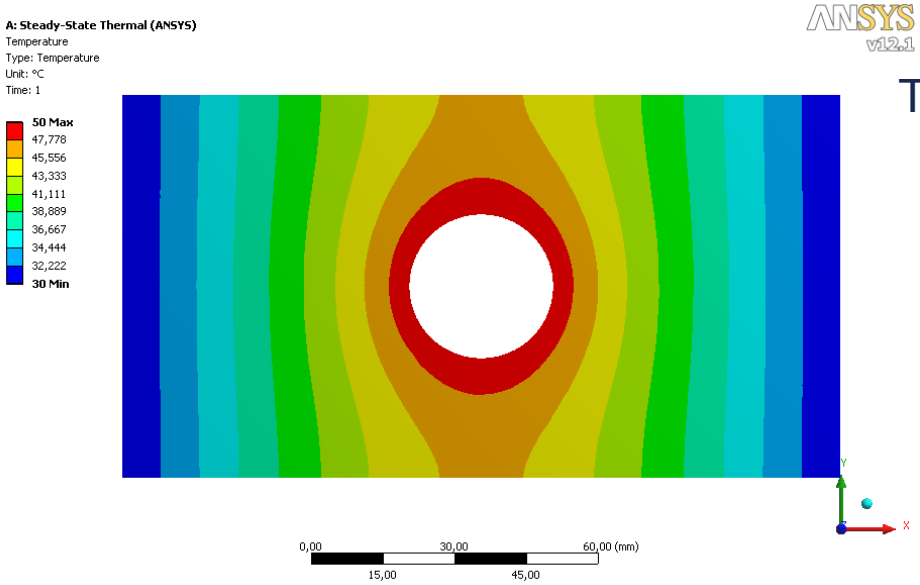
- Example: consider a plate with a hole.
  - First, a thermal study is defined to calculate temperature field.
  - A structural study is carried on, evaluating stresses due to temperature distribution.
  - Residual thermal stresses are used as initial condition for the model, when subjected to a tensile load.



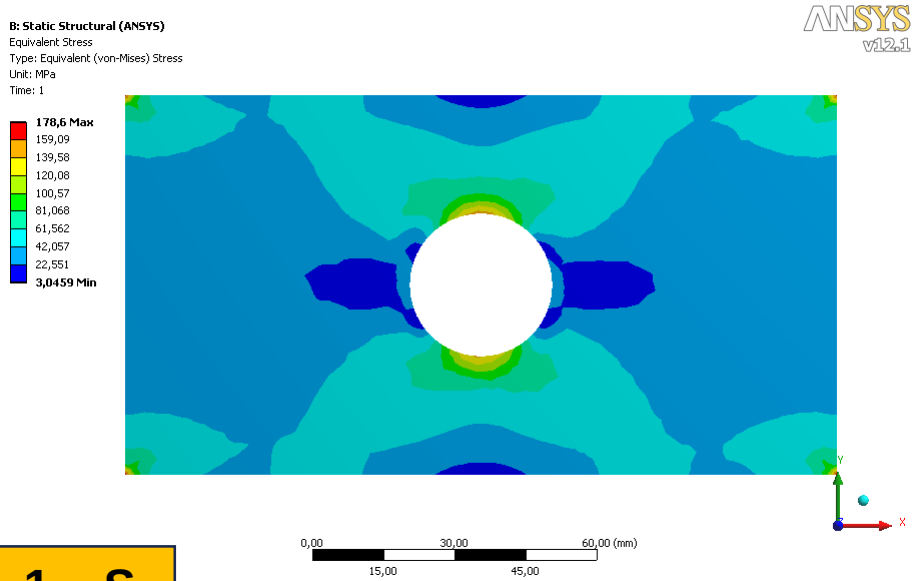


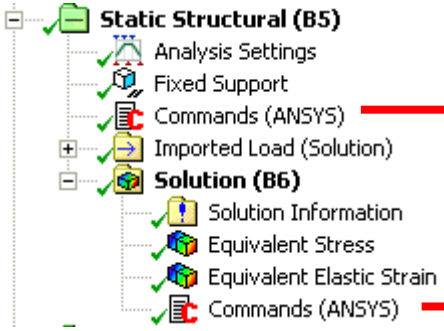
INITIAL STATE

- Initial stress state evaluation.



Temperature distribution from thermal study





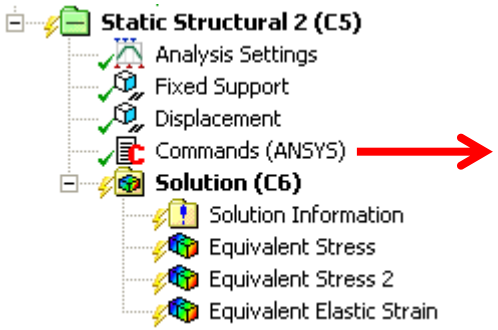
INISTATE, WRITE, 1, , S

/COPY, file, ist, , file, ist, ..\..

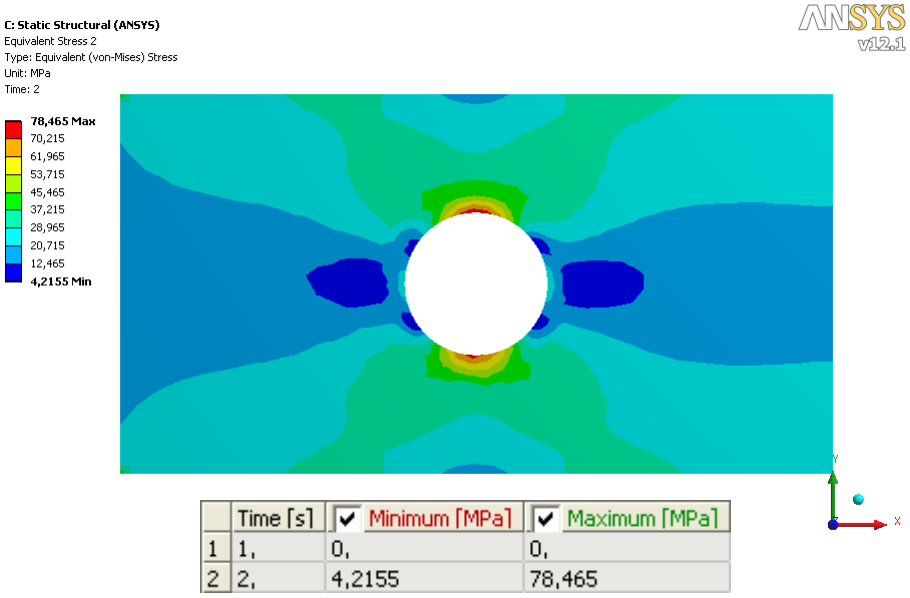
Stress distribution

INITIAL STATE

- Initial stress state reading.

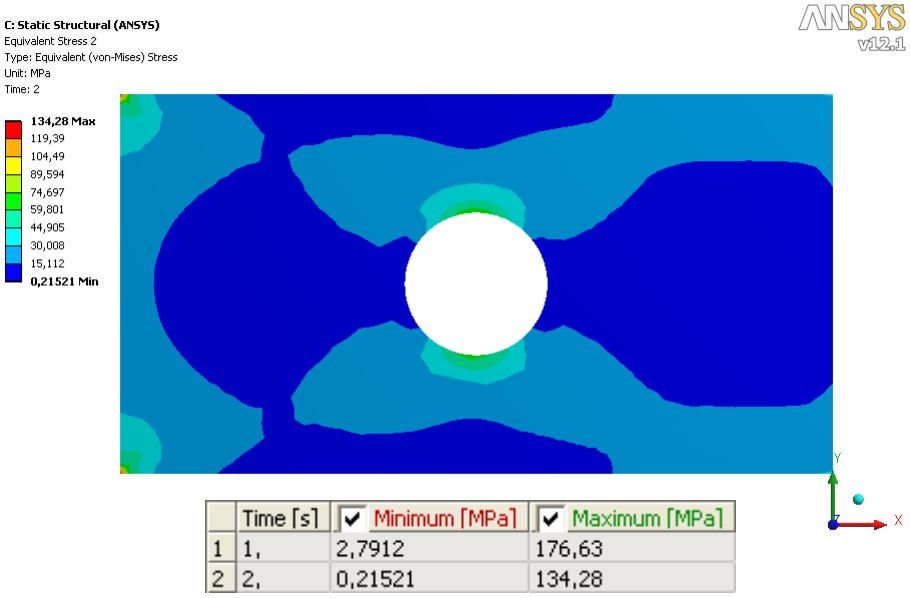



```
/COPY, file, ist, ..\..\, file, ist
INISTATE, READ, file, ist
```



	Time [s]	Minimum [MPa]	Maximum [MPa]
1	1,	0,	0,
2	2,	4,2155	78,465

Without initial state



	Time [s]	Minimum [MPa]	Maximum [MPa]
1	1,	2,7912	176,63
2	2,	0,21521	134,28

With initial state