

# Use of Z-mat with Abaqus

Z-set group

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# Summary



- 1 Z-mat with Abaqus
- 2 Zmaster/Z-post on odb files
- 3 Zsopt material calibration

# Environment variables



## Linux:

- `setenv Z7PATH /home/your_path/Z9.0`
- `source $Z7PATH/lib/Z7_cshrc`
- `setenv ABAQUS_ROOT /home/path_to_abaqus_installation`

## Windows:

- `set Z7PATH=C:\your_path\Z9.0`
- `set PATH=%PATH%;%Z7PATH%\win64`
- `set ABAQUS_ROOT=C:\path_to_abaqus_installation`

# Modifications to the Abaqus input file

Zmat material file: **zmat**

Abaqus input file:  
cyclic\_abaqus.inp

```
*NODE ...
*SOLID SECTION,ELSET=EALL,MATERIAL=zmat
*MATERIAL,NAME=zmat
*DEPVAR
  19
*USER MATERIAL,CONSTANTS=1
0.0
*STEP ..
```

```
***material
*integration theta_method_a 1. 1.e-10 50
***behavior gen_evп
**elasticity
  young 200000.
  poisson 0.300000
**potential gen_evп ep
*critерion mises
*flow plasticity
*isotropic nonlinear
  R0 300.000
  Q 100.000
  b 10.0000
*kinematic nonlinear
  C 25000.0
  D 50.0000
***return
```

Command: \$ Zmat cyclic\_abaqus

# Zpreload utility

- Checks the behavior definition
- Printouts the names and number of SDVs needed by the Zmat model
- Command: `$ Zpreload zmat`
- 3D default output, for 2D use `Zpreload -d 2 ...`

```
Reading behavior in file: zmat
```

```
=====
```

```
..
```

```
var_int Name:
```

```
  ee111(sdv1) ee122(sdv2) ee133(sdv3) ee112(sdv4) ee123(sdv5)
  ee131(sdv6)
  epcum(sdv7)
  al111(sdv8) al122(sdv9) al133(sdv10) al112(sdv11) al123(sdv12)
  al131(sdv13)
```

```
var_aux Name:
```

```
  epi11(sdv14) epi22(sdv15) epi33(sdv16) epi12(sdv17) epi23(sdv18)
  epi31(sdv19)
```

```
=====
```

```
done with material file reading...
```

▶ Zpreload zmat

▶ Zpreload -d 2 zmat

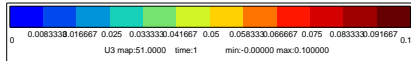
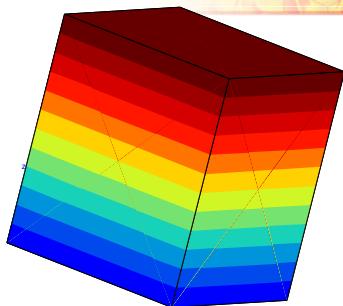


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# Reading odb files with the Zmaster GUI



- Alternative to abaqus viewer
- Basic graphical post-treatment operations
- Preserve Zmat's SDV names
- Iso-contours at integration points

► Zodb -G cyclic\_abaqus.odb



# Running Z-post on odb files

- General batch post-processing
- Damage post-processing
- Reading/Writing of odb files

```
****post_processing
***data_source odb
**open cyclic_abaqus.odb
***data_output odb
**problem_name zpost_for_abaqus
***local_post_processing
...
**process range
**var sig
****return
```

▶ Zodb -pp zpost\_for\_abaqus

▶ Viewer

▶ Open terminal

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# Single element Abaqus vs Z-sim

- Common material file for model calibration and FE analysis
- Definition of the cyclic test using Zsim
- Driving of Abaqus in SimOpt using external simulations
- Advantages of Z-sim for calibration:
  - easy definition (no mesh, boundary conditions, steps etc..)
  - very fast (mandatory for automatic optimization)

▸ Zsopt cyclic

▸ Open terminal