NWN Z-MAT 2016 DATASHEET

Z-mat Library

Algorithms

Integrators

- Backward Euler
- Forward Euler
- Mid-point
- Runge-Kutta

Solution methods

- Newton's
- Combined with other root finding algorithms

Fail-safe roll over algorithms

Controls and tolerances for all

- Load sub-increments

Material coefficients

Tabular data

Interpreted functions (applies to coefficients of every model)

Function of temperature and other prescribed variables

Storage of values

General Properties

Thermal behavior (conductivity, heat capacity)

Diffusion behavior (diffusivity, generalized damping)

Phase change / latent heat

Mechanical Properties

Elasticity (iso, ortho, aniso)

Hyperelasticity (Arruda-Boyce, Mooney-Rivlin, Ogden, etc.)

Thermal expansion (iso, ortho, aniso)

Mechanical phase strain

Adiabatic heating

Maxwell viscoelasticity

Frameworks

Gen_evp

Porous_plasticity

Finite_strain_plasticity

Gen_evp Potentials

Viscoplasticity / Chaboche (coupled with damage)

Associated flow

SUVIC kinematic hardening models

Delobelle model with recovery

Ratcheting model

Drucker-Prager (including kinematic hardening)

Single crystals (FCC, BCC, HCP)

Porous_plasticity components

Plasticity potentials

- Gurson
- Elliptic
- Rousselier
- Cam-clay

Nucleation models

- Gaussian
- Exponential

Kinematic hardening

Finite_strain_plasticity

Potentials

All can be combined with kinematic hardening and hyperelasticity

Viscoplastic Norton's flow

Rate independent plasticity

Associated versions

Flow potentials

Time independent plasticity

Multi-Norton viscoplastic rate

Hyperbolic

Strain hardening

Norton with exponential overstress

Inverse exponential

Inverse summation of rates

Bodner-Partom

MATMOD

Yield criteria

Von Mises

Tresca

Linear Drucker-Prager

Hill / General anisotropic

Isotropic hardening

Constant, linear, nonlinear

Tabular

Recovery

Double saturation rate

Power law

Strain range memory model

Kinematic hardening

Linear, nonlinear (FA, Chaboche)

With static recovery / creep

Nonlinear with evolving saturation

Linear to nonlinear

3D ratcheting control (Evrad)

Delobelle model

Crystalline models

Anisotropic nonlinear

Damage and modifiers

Isotropic damage variable

- Plastic strain
- Creep strain
- Fatigue damage
- Elastic energy
- Combination

Anisotropic damage (with anisotropic viscoplasticity)

Polycrystal localization

Z-opt/Z-sim

Optimization Algorithms

Simplex, SQP

Nelder-Mead

Levenberg-Marquadt

Genetic Evolution

Any number of variables

Objective functions with weights

Test Data

General FE results of a BVP

Uniaxial, Biaxial, Simple shear (rate dependent)

Cyclic stress/strain (rate dependent)

Cycle and hold

SRP (strain range partitioning)

Relaxation and creep

Z-post

Max / min / average analysis

Averages in and around elements

Weibull, Beremin analysis

Standard post-processing (all invariants of all tensors, their norms, principal values and Eigen vectors)

Material computations for cycles skipped during analysis

Cycle-skipping, when applicable

Strain and stress based fatigue

Creep damage

LCF / HCF fatigue models

SWT, Chaboche TMF models and proprietary extensions

ASCII export with arbitrary precision