

ANSYS Class3 Error Report

ERROR NO:QA2010-01

Keywords:

TEMPERATURE-DEPENDENT MULTILINEAR KINEMATIC HARDENING PLASTICITY
MKIN KINH THERMAL CYCLING

Description of Error:

Results using one of the multilinear kinematic hardening options (TB,MKIN with TBOPT=2 or TB,KINH) with temperature-dependent input curves (TBTEMP) subject to cyclic thermal loads may show erratic behavior and produce inconsistent results. The erratic behavior occurs after a few thermal cycles; the initial cycle(s) produce valid results (within engineering accuracy). Some of this behavior includes:

- erratic and sometimes very large plastic strain ratios during the equilibrium iterations
- non-convergence
- POST26 plots of stress-strain behavior showing non-smooth and erratic curves, and stress and strain contours showing non-smooth result fields (PLESOL in particular)

While these results are observable and clearly questionable, you should not use them to confirm or deny ratcheting or shakedown.

Typical GUI Path(s):

Main Menu>Preprocessor>Material Props>Material Models

Other Comments:

The numerical issue is introduced due to the ratioing of the "sublayer" plastic strains when the temperature changes in order to ensure that the total plastic strains (sum of each sublayer plastic strains) remain constant. Small numerical round-off perturbations are introduced into the solution, which can cause the solution to become erratic. This behavior is intensified by a large number of thermal cycles and by elements with extra shape functions (default in SOLID42 and SOLID45)/enhanced strains (SOLID182 with KEYOPT(1)=2 or 3 and SOLID185 with KEYOPT(2)=2 or 3).

First Incorrect Version:

Release 5.1

Corrected In:

Release 13.0

Suggested User Action For Running on Uncorrected Version:

Use the Chaboche model (TB,CHABOCHE) for thermal cycling analyses.

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