

UMAT, UHYPER

Input files

umatmst3.inp	Mises plasticity, uniaxial tension, three-dimensional solid.
umatmst3.f	User subroutine UMAT used in umatmst3.inp.
umatmss3.inp	Mises plasticity, simple shear, three-dimensional solid.
umatmss3.f	User subroutine UMAT used in umatmss3.inp.

II. USER SUBROUTINE FOR HYPERELASTIC MODEL

Elements tested

C3D8 CPE4

Problem description

This set of verification problems is primarily intended to test the deformation gradient that is passed into **UMAT**. Variables in subroutine **UHYPER** that are functions of the deformation gradient are also tested. The structure being analyzed for the two-dimensional case is a unit square made up of three coincident CPE4 elements. The three-dimensional case consists of a cube of unit dimensions made up of three coincident C3D8 elements. For both cases the material properties of the first element are specified directly with general hyperelastic material properties. The same material properties are defined for the second and third elements through user subroutines **UMAT** and **UHYPER**, respectively. The displacements are prescribed at each of the nodes of the models, thus the stresses induced in each element will be the same.

Material:

Hyperelasticity: Mooney-Rivlin

$$C_{10} = 80.0$$

$$C_{01} = 0.0$$

$$D_1 = 2.013\text{E-}4$$

Results and discussion

The tests in this section are set up as cases of homogeneous deformation of three elements of unit dimensions. Consequently, the results are identical for all integration points within each of the elements. In each case the constitutive path is integrated with 10 increments of fixed size.

Input files

umathrt2.inp	Hyperelasticity, uniaxial tension, two-dimensional solid.
umathrt2.f	User subroutines UMAT and UHYPER used in umathrt2.inp.
umathrs2.inp	Hyperelasticity, simple shear, two-dimensional solid.
umathrs2.f	User subroutines UMAT and UHYPER used in umathrs2.inp.

umatht3.inp	Hyperelasticity, uniaxial tension, three-dimensional solid.
umatht3.f	User subroutines UMAT and UHYPER used in umatht3.inp.
umathrs3.inp	Hyperelasticity, simple shear, three-dimensional solid.
umathrs3.f	User subroutines UMAT and UHYPER used in umathrs3.inp.

III. USER SUBROUTINE FOR TOTAL AND INCOMPRESSIBLE HYBRID FORMULATIONS

Element tested

C3D8H

Problem description

This set of verification problems is primarily intended to test the total and incompressible hybrid formulations with user subroutine **UMAT**.

Material:

Hyperelasticity: neo-Hookean

$$C_{10} = 100.0$$

$$D_1 = 1.E-03 \text{ or } D_1 = 0$$

Results and discussion

The tests in this section are set up as cases of homogeneous deformation. For each case the results are compared against native Abaqus models and are found to be identical to the latter.

Input files

mhnndo3gsh_umat.inp	Almost incompressible hyperelasticity, planar tension, three-dimensional solid.
mhnndo3gsh_umat.f	User subroutine UMAT used in mhnndo3gsh_umat.inp.
mhncoo3hut_umat.inp	Fully incompressible hyperelasticity, uniaxial tension, three-dimensional solid.
mhncoo3hut_umat.f	User subroutine UMAT used in mhncoo3hut_umat.inp.

IV. USER SUBROUTINE FOR FREQUENCY DOMAIN VISCOELASTIC BEHAVIOR

Element tested

C3D8