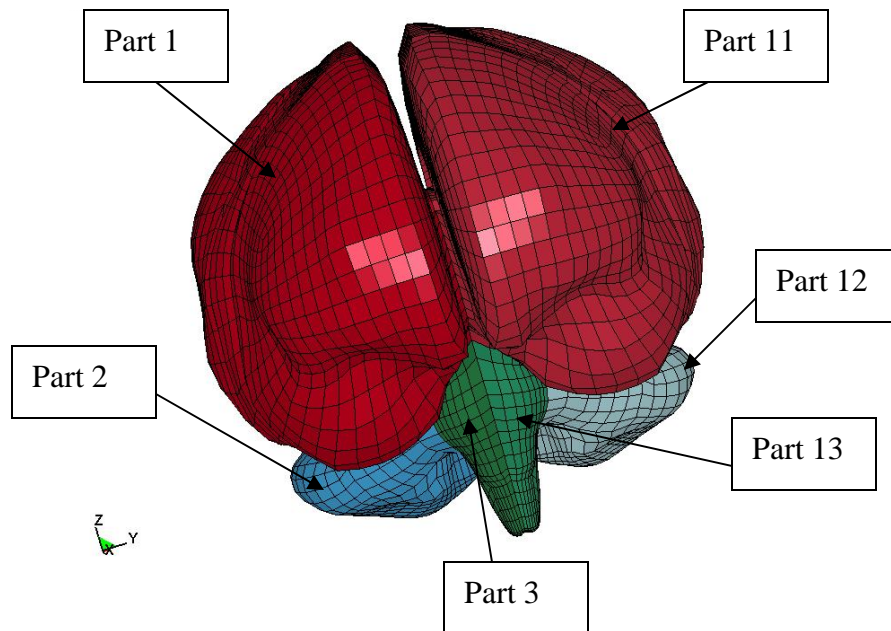


New CSDM Calculation for New SIMon model

The new Cumulative Strain Damage Measure (CSDM) corresponding to any strain level can be computed using Isprepost software. This can be accomplished using a macro that employs Isprepost commands. CSDM calculation in new SIMon model is based on the following six parts:

- Cerebrum-Left (Part # 11)
- Cerebrum-Right (Part # 1)
- Cerebellum-Left (Part # 12)
- Cerebellum-Right (Part # 2)
- Brain Stem-Left (Part # 13)
- Brain Stem-Right (Part # 3)



Procedure:

The following procedure is followed to compute CSDM

1. First, the volume of each part exceeding a specified strain value, V_{D1} , is computed:

$$V_{D1} = V_{F1} \times V_{P1}$$

where,

V_{F1} represents the volume fraction for part1

V_{P1} represents the total volume of part1

Similar procedure is followed for all the parts.

2. The total volume, V_{Total} , of all the six parts is computed:

$$V_{Total} = V_{P1} + V_{P2} + V_{P3} + V_{P11} + V_{P12} + V_{P13}$$

3. A new volume fraction is calculated for each part based on the total volume:

$$V_{F1new} = \frac{V_{D1}}{V_{Total}}$$

Similar procedure is followed for all parts.

4. The new volume fractions for all the parts are then added to compute CSDM

$$CSDM = V_{F1new} + V_{F2new} + V_{F3new} + V_{F11new} + V_{F12new} + V_{F13new}$$

Macro with explanation

The following macro is used to compute CSDM. The macro shown is for critical strain value of 0.25. This value can be changed as required.

**lsprepost macro command file*

**macro begin CSDM_0.25_NEW_CALCULATION*

restore

**PART1 WINDOW-----*

selectpart on H1/0
vftime 7 1 0.25

Part1 is selected and volume fraction time history is plotted (V_{F1}) for critical strain value of 0.25

addplot

ident part H1/0 ;
Solid Part #1
measure history vol v

Part1 is selected and volume time history is plotted (V_{P1})

xyplot 1 select 1
xyplot 1 select 2

Part 1 volume fraction (V_{F1}) is multiplied by part 1 volume (V_{P1}) to get the volume of part1 exceeding a specified strain value (V_{D1})

xyplot 1 operation multiply_curves 1/2

selectpart on H1/0 H2/0 H3/0 H11/0 H12/0 H13/0

All six parts are selected

addplot

measure history vol v all

Volume time history of all six parts is plotted (V_{Total})

xyplot 1 operation divide_curves 1/3

New volume fraction is calculated for part1 (V_{F1new})

restore

Model is restored

**PART2 -----*

addplot
selectpart on H2/0
vftime 7 2 0.25
addplot
ident part H2/0 ;

Similar procedure is followed to get V_{F2new}

Solid Part #2

measure history vol v

xyplot 1 select 4

xyplot 1 select 5

xyplot 1 operation multiply_curves 4/5

xyplot 1 operation divide_curves 4/3

restore

**PART3 -----*

addplot

selectpart on H3/0

vftime 7 3 0.25

addplot

ident part H3/0 ;

Solid Part #3

measure history vol v

xyplot 1 select 6

xyplot 1 select 7

xyplot 1 operation multiply_curves 6/7

xyplot 1 operation divide_curves 6/3

restore

**PART 11 -----*

addplot

selectpart on H11/0

vftime 7 11 0.25

addplot

ident part H11/0 ;

Solid Part #11

measure history vol v

xyplot 1 select 8

xyplot 1 select 9

xyplot 1 operation multiply_curves 8/9

xyplot 1 operation divide_curves 8/3

restore

**PART12 -----*

addplot

selectpart on H12/0

vftime 7 12 0.25

addplot

ident part H12/0 ;

Solid Part #12

measure history vol v

xyplot 1 select 10

xyplot 1 select 11

xyplot 1 operation multiply_curves 10/11

xyplot 1 operation divide_curves 10/3

restore

**PART 13 -----*

addplot

selectpart on H13/0

vftime 7 13 0.25

Similar procedure is followed to get V_{F3new}

Similar procedure is followed to get V_{F11new}

Similar procedure is followed to get V_{F12new}

Similar procedure is followed to get V_{F13new}

```

addplot
ident part H13/0 ;
Solid Part #13
measure history vol v
xyplot 1 select 12
xyplot 1 select 13
xyplot 1 operation multiply_curves 12/13
xyplot 1 operation divide_curves 12/3
restore
*ADD ALL-----
xyplot 1 select 1
xyplot 1 select 4
xyplot 1 select 6
xyplot 1 select 8
xyplot 1 select 10
xyplot 1 select 12
xyplot 1 operation sum_curves 1/4/6/8/10/12
*-----
xyplot 1 title "CSDM 0.25_NEW_CALCULATION"
xyplot 1 minmax on
*macro end

```

All the V_{Fnew} curves's are selected and summed to obtain the CSDM value.

The macro is included in the installation directory. This macro can be run from page 4 of Ls-prepost which gives the option of adding a macro and executing it.