MEG 795 Special Topics: Energy Methods II

COMPUTATIONAL SIMULATION OF TENSILE TESTING USING SPECIMENS OF DIFFERENT CONFIGURATIONS

(NOTCHED TENSILE TEST III)
(NOTCHED TENSILE TEST OF A COMPACT TENSION SPECIMEN)

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OBJECTIVE

- **The primary goal of this study is to evaluate the mechanical properties of a Compact Tension (CT) specimen by developing a computational model.**

- **To study the effect of different mesh configurations on the refinement of the generated data.**

- **To compare the results obtained with the current computation with earlier computation results.**

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Material Properties to be Evaluated

- **Maximum Stress at an initial velocity of 50 inch/sec**
- **Resultant Displacement**
- **Effective Plastic Strain**

Modeling

- **The CT specimen was modeled using Solid Works**
- **ASTM standard E 399 CT dimensions were observed for modeling**
- **The width (B) of the specimen was maintained at 1 inch and height (H) was 2.40 inches (1.25W) and distance from the crack tip to the to the centre of the hole is 0.55 inches**

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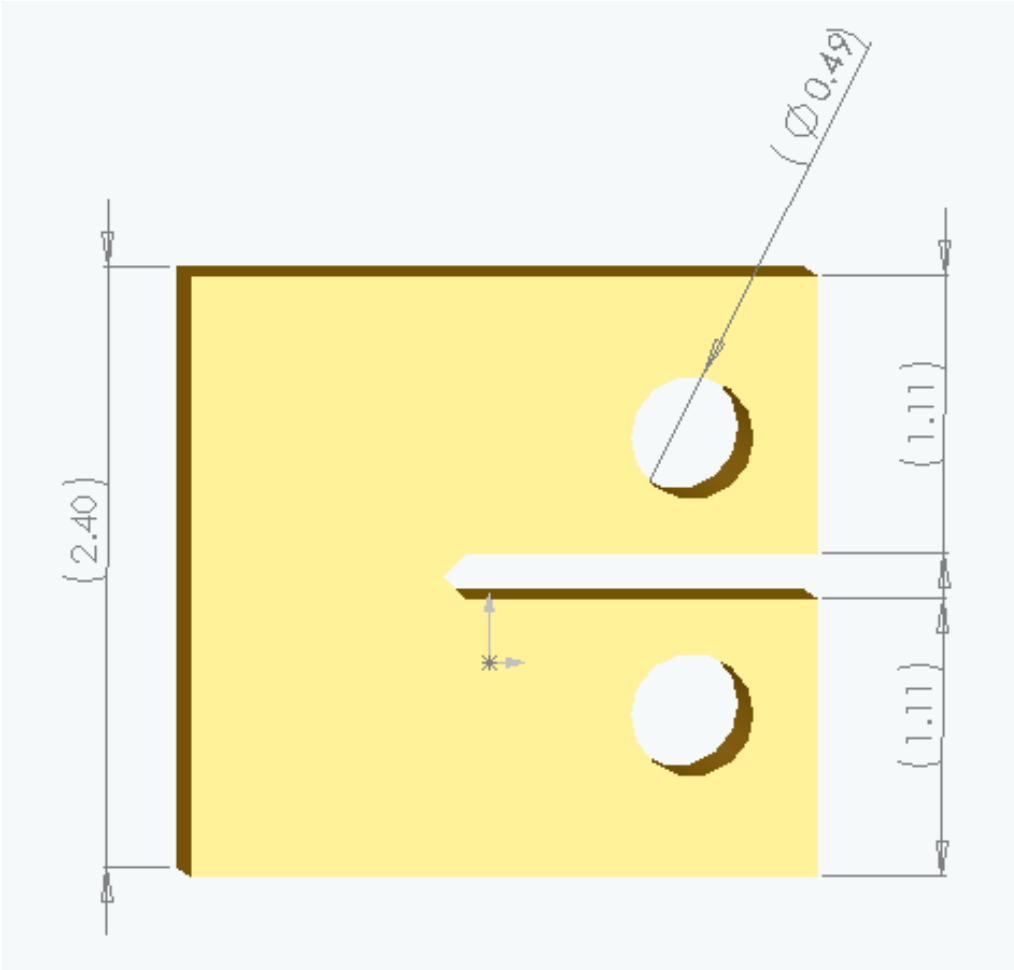
SolidWorks Model



EP-823 COMPACT TENSION (CT) SPECIMEN

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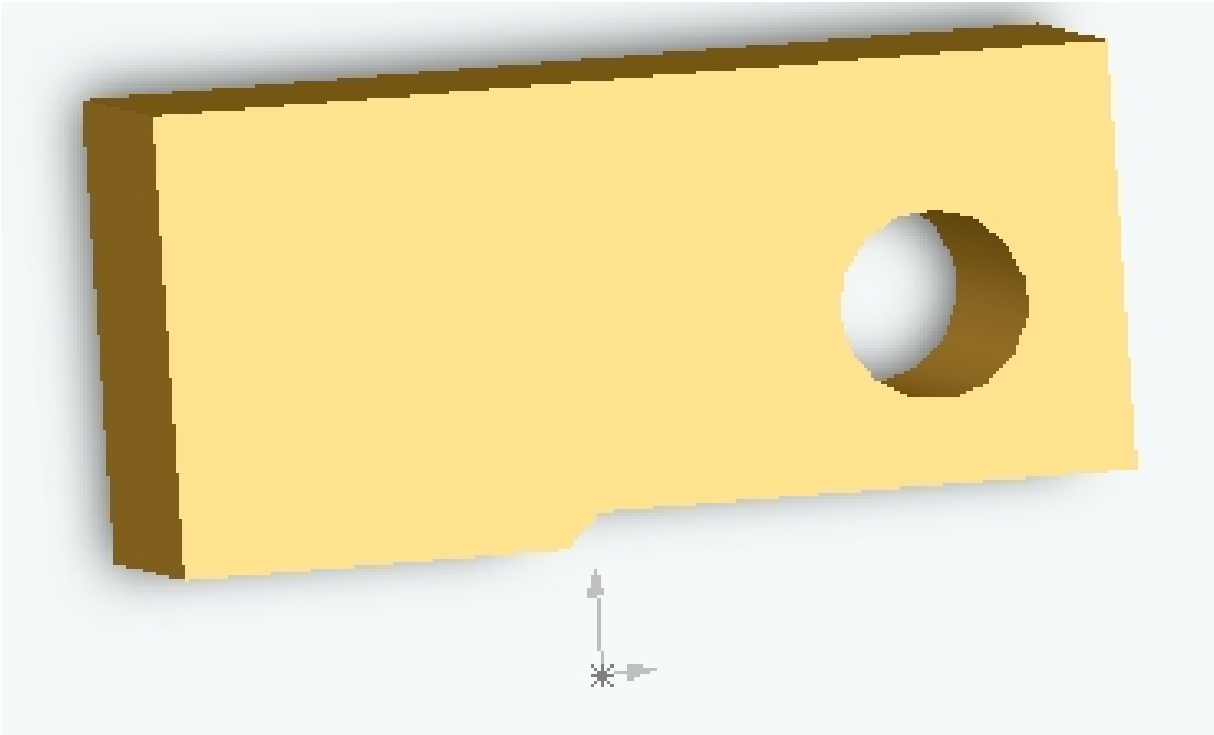

Half-Section Chosen For Analysis

Material Input for the Specimen

Material	Element Type	Material Model	Material Properties
EP-823	3-D Solid 164	Non-Linear Isotropic	Density: 0.283599 lb/in^3 Yield Stress:110 $*10^3$ Psi E: 3 $*10^7$ Psi

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Meshing Technique

- **The model was imported in ANSYS to perform different meshing schemes.**

- **The half-sectioned model is meshed as solid elements**

- **Two meshing schemes were used as follows:**
  - **→ Mesh I**
  - **→ Mesh II (Refined Mesh)**

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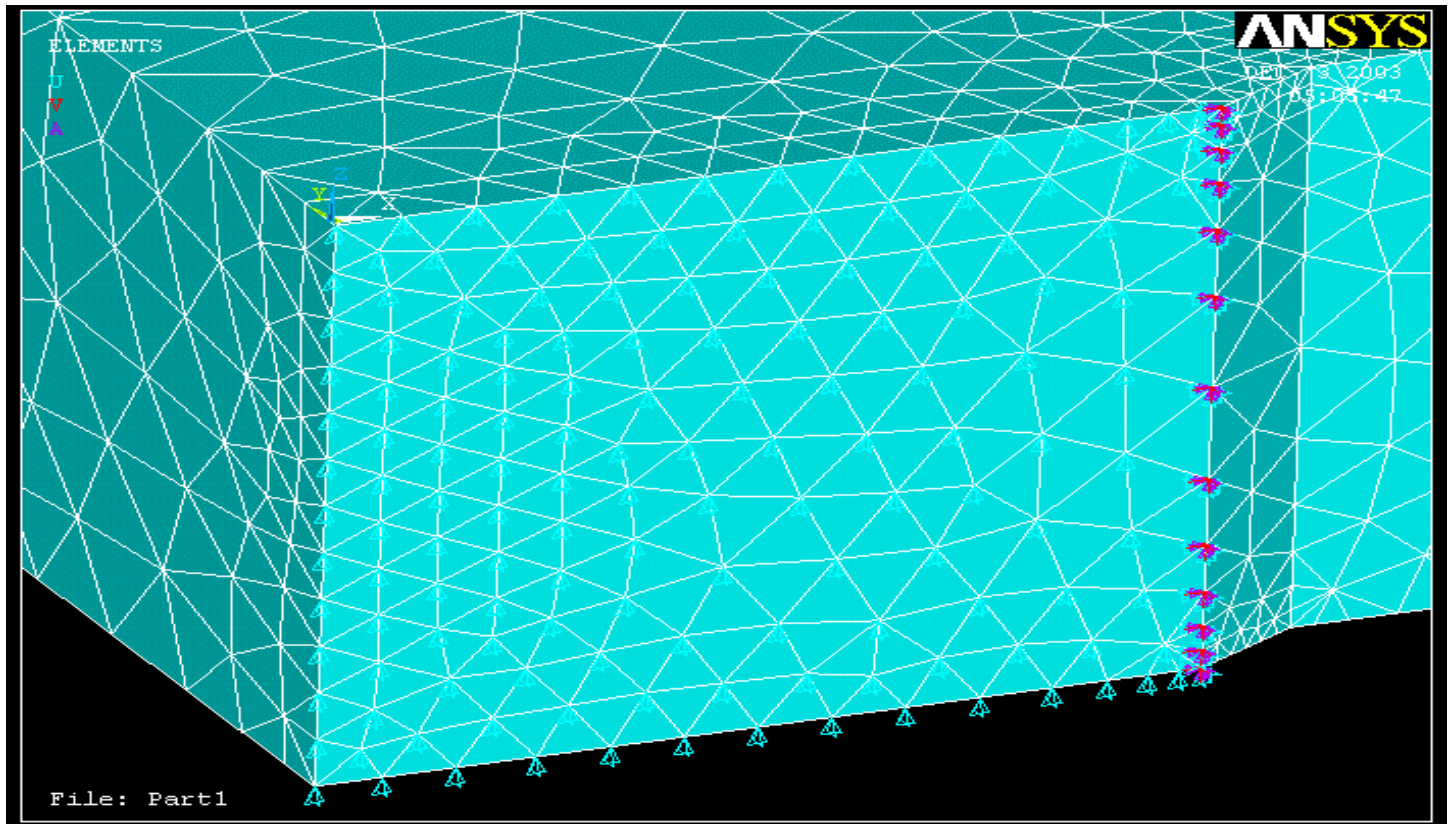
Meshed Model



CT Specimen (Meshed with Constraints- Surface adjacent to the notch)

(MESH I- Coarse Mesh)

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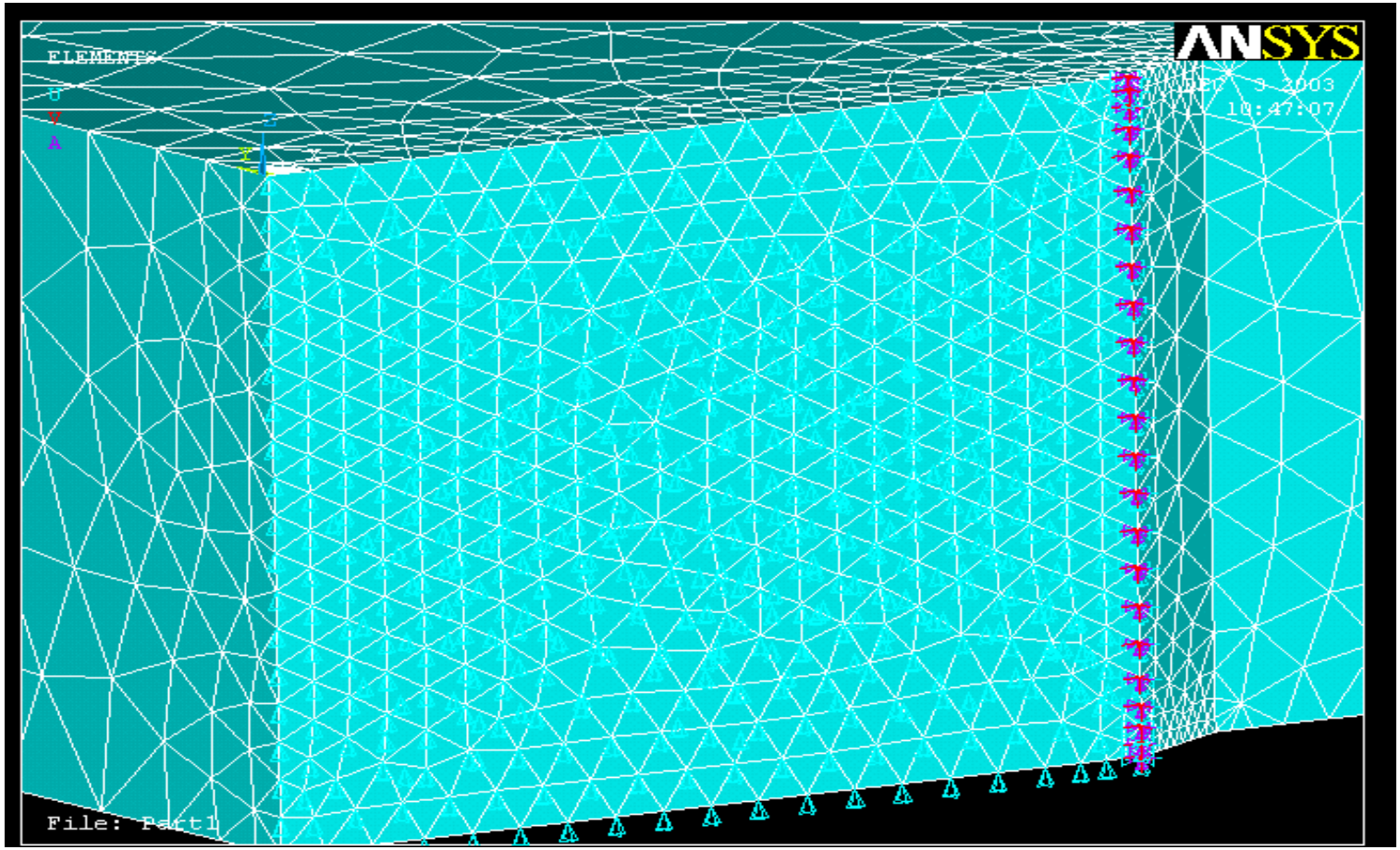

CT Specimen (Meshed with Constraints- Surface adjacent to the notch)

(MESH II – Finer Mesh)

Results from LS DYNA Analysis

→ PARAMETERS TO BE EVALUATED

- **Maximum Stress at an initial velocity of 50 inch/sec**

→ CONTOURS PLOTTED

- **Maximum Stress Contour**
- **Effective Stress Vs. Time**
- **Resultant Displacement Vs. Time**
- **Effective Plastic Strain Vs. Time**

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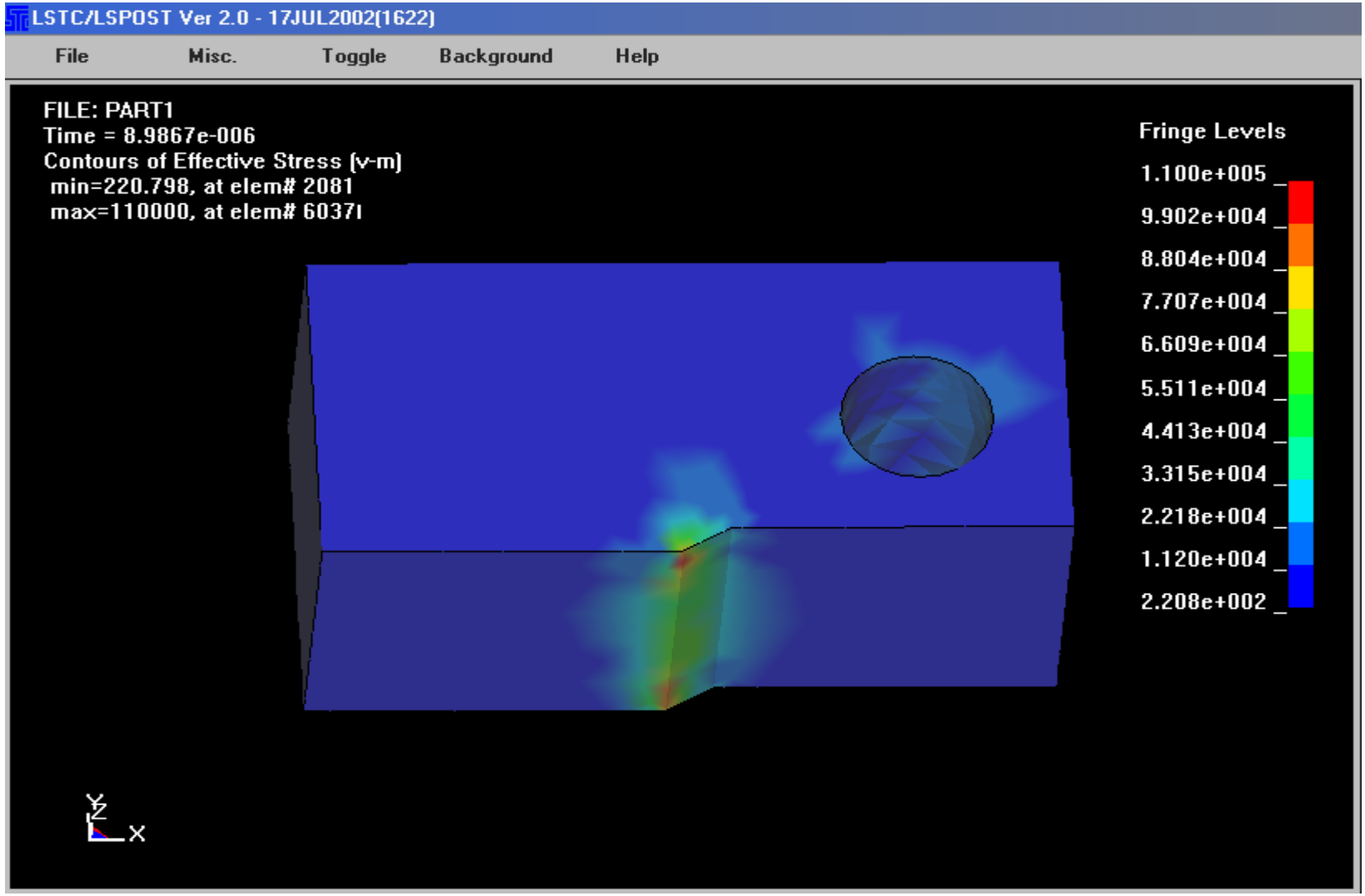

Maximum Stress Contour (Mesh I)

Max. Stress = 110 ksi

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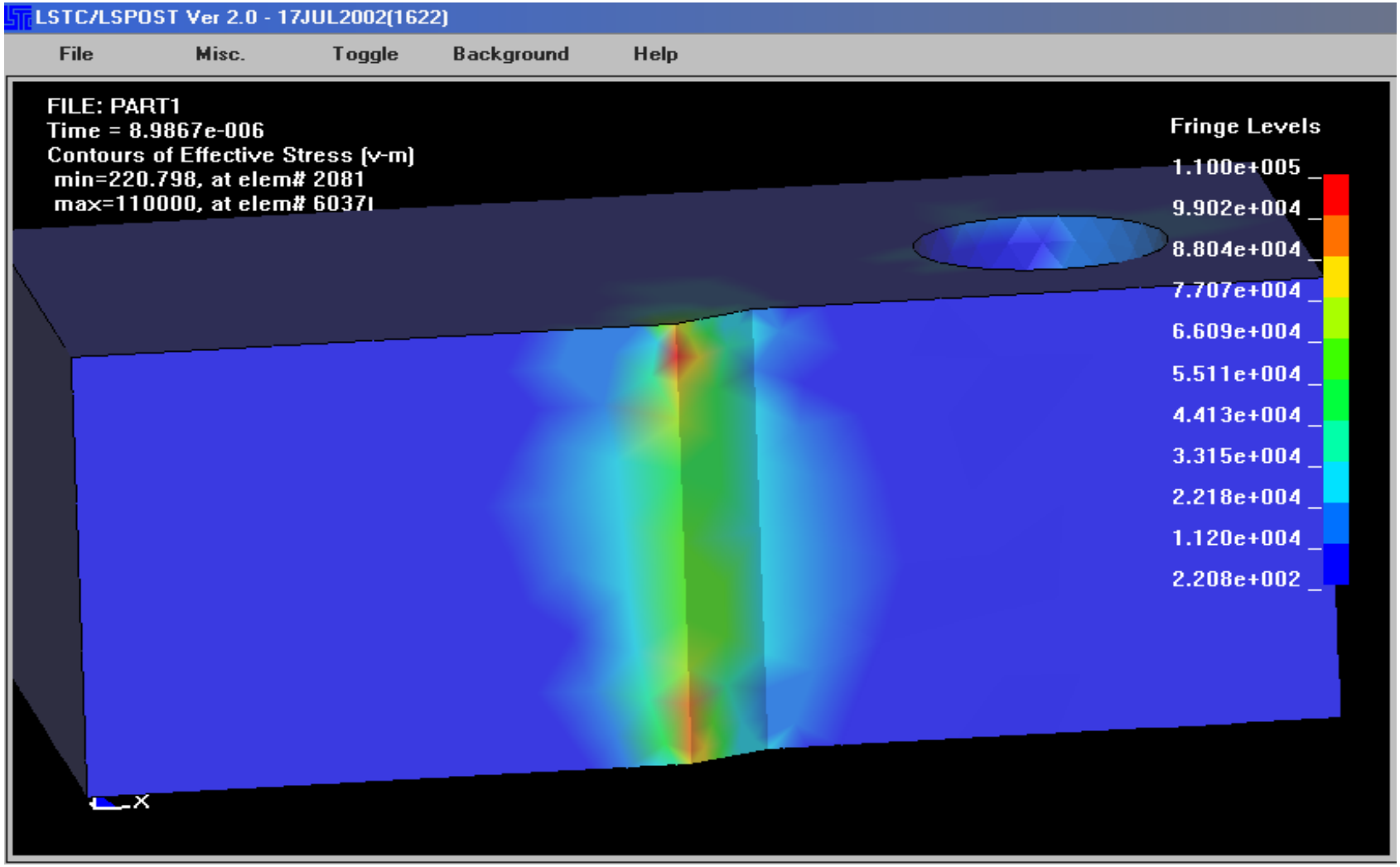

Maximum Stress Contour in the notched region from LS DYNA

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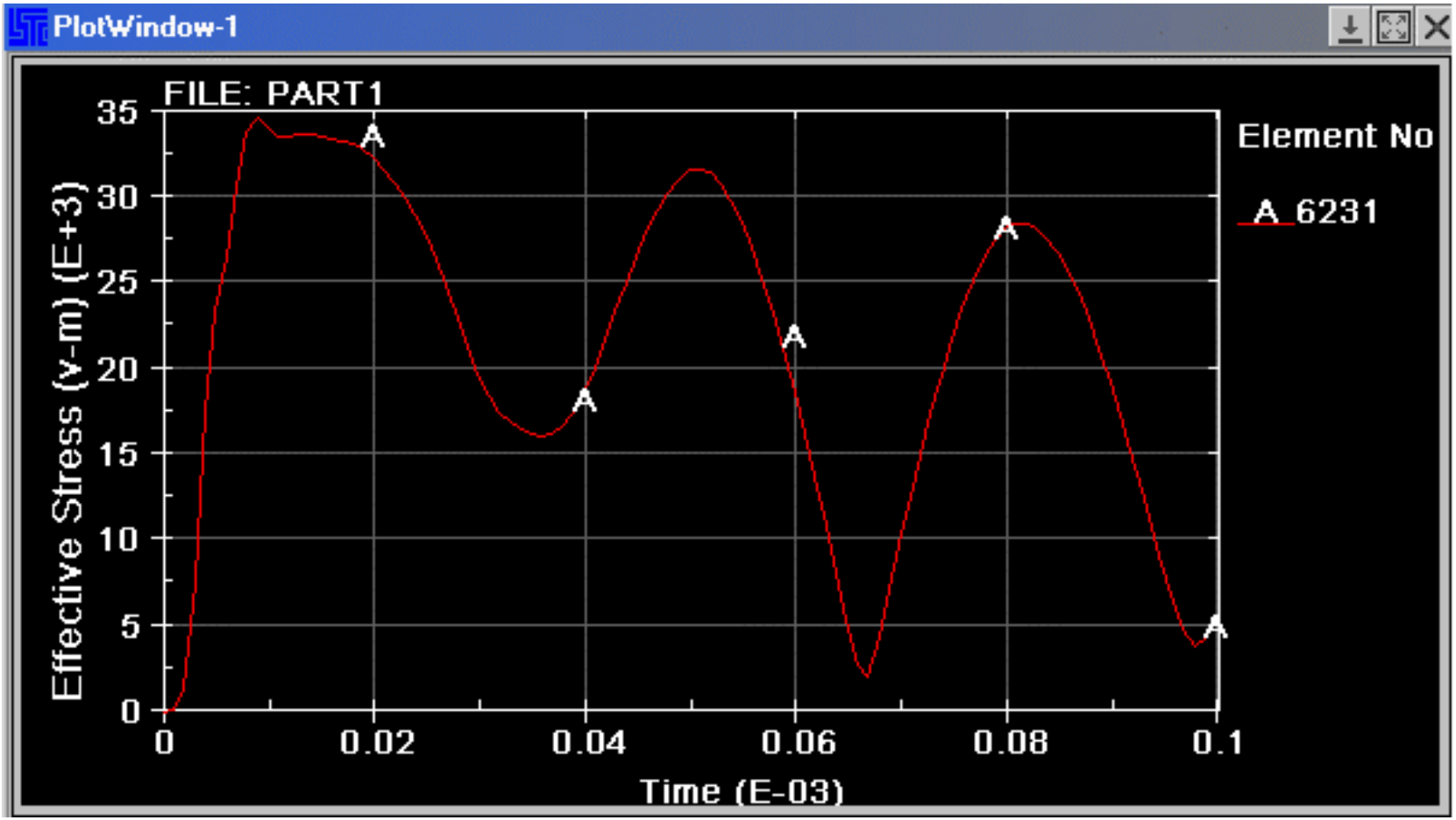

Effective Stress vs. Time

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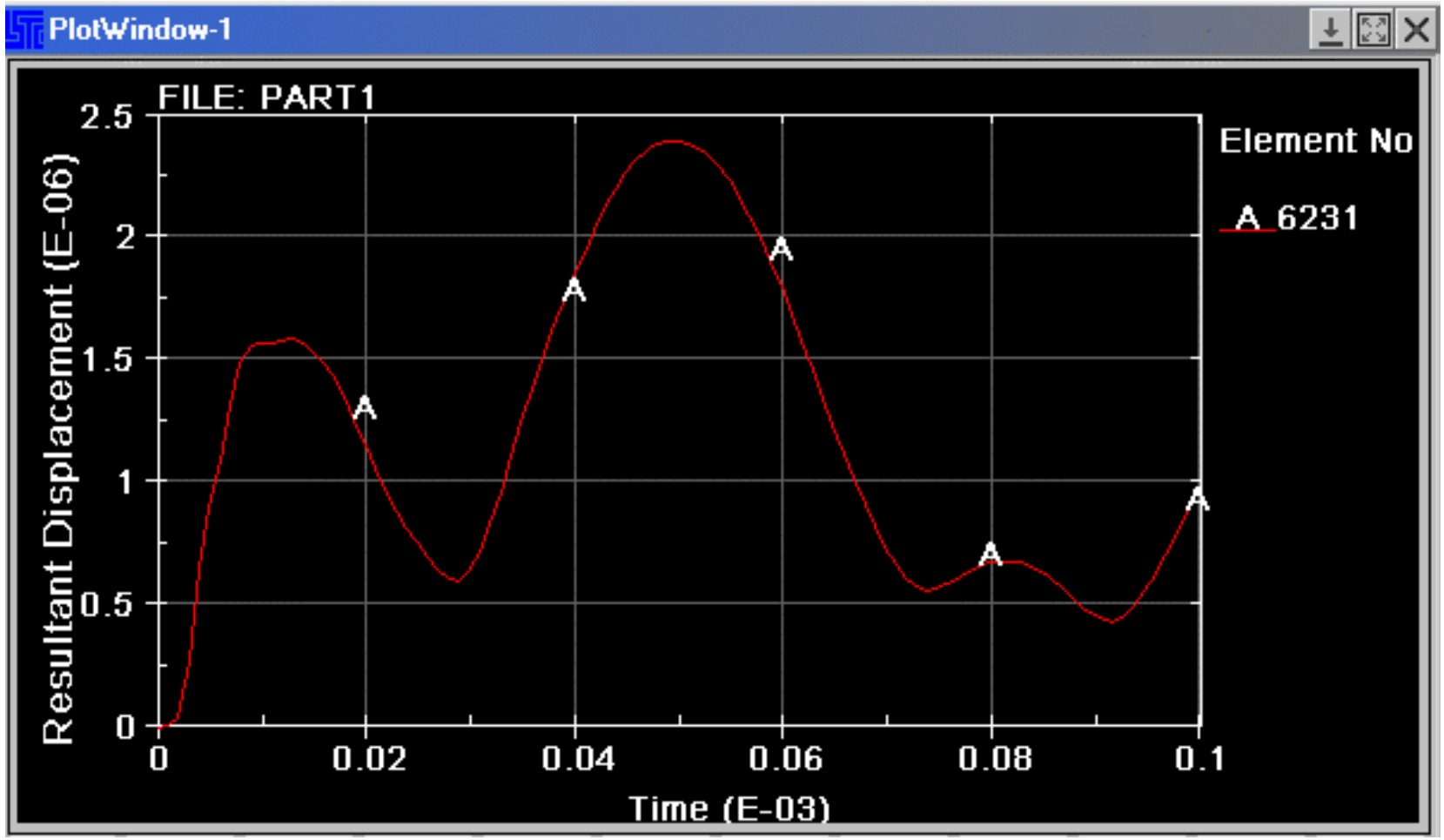

Resultant Displacement vs. Time

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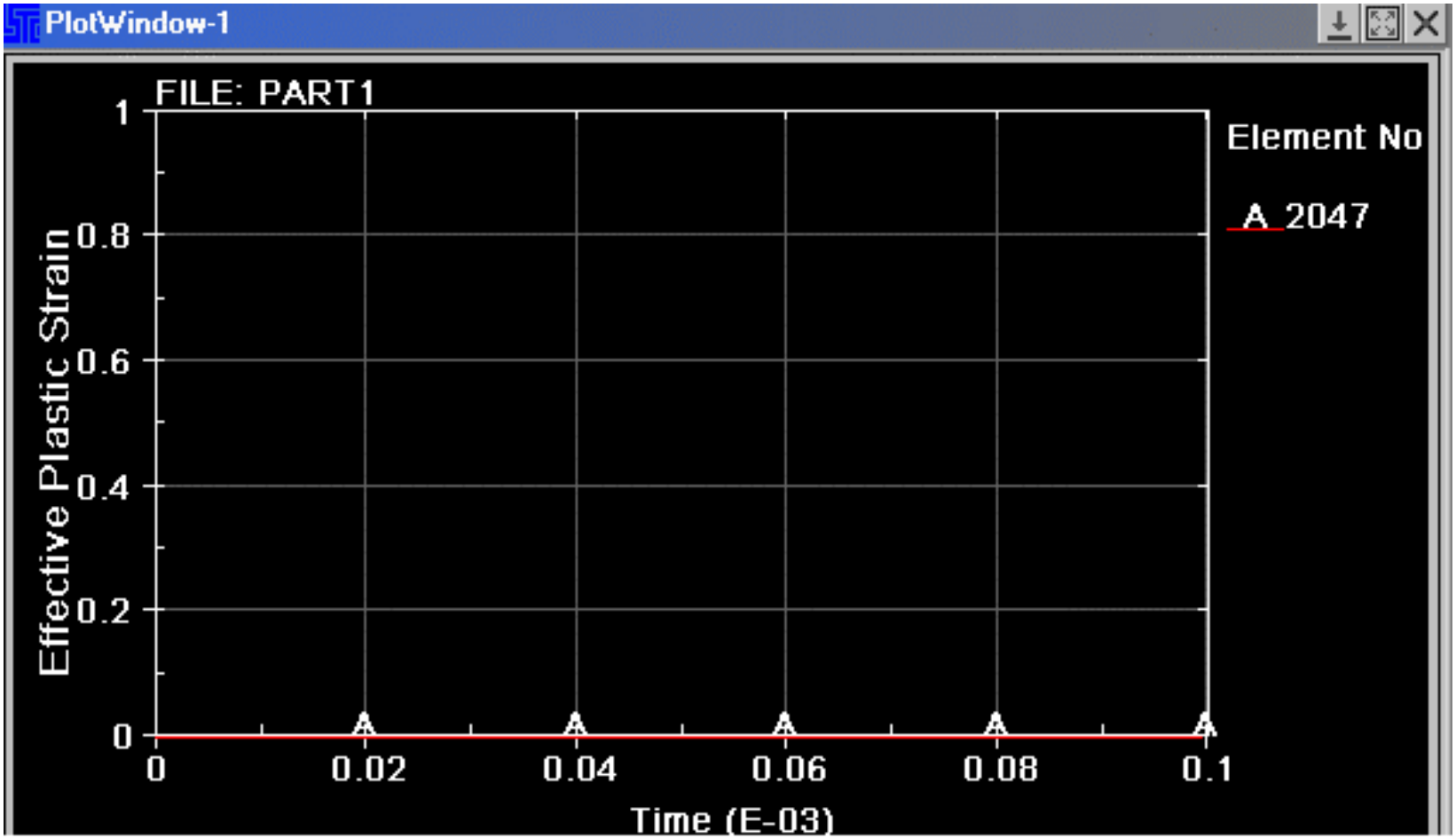
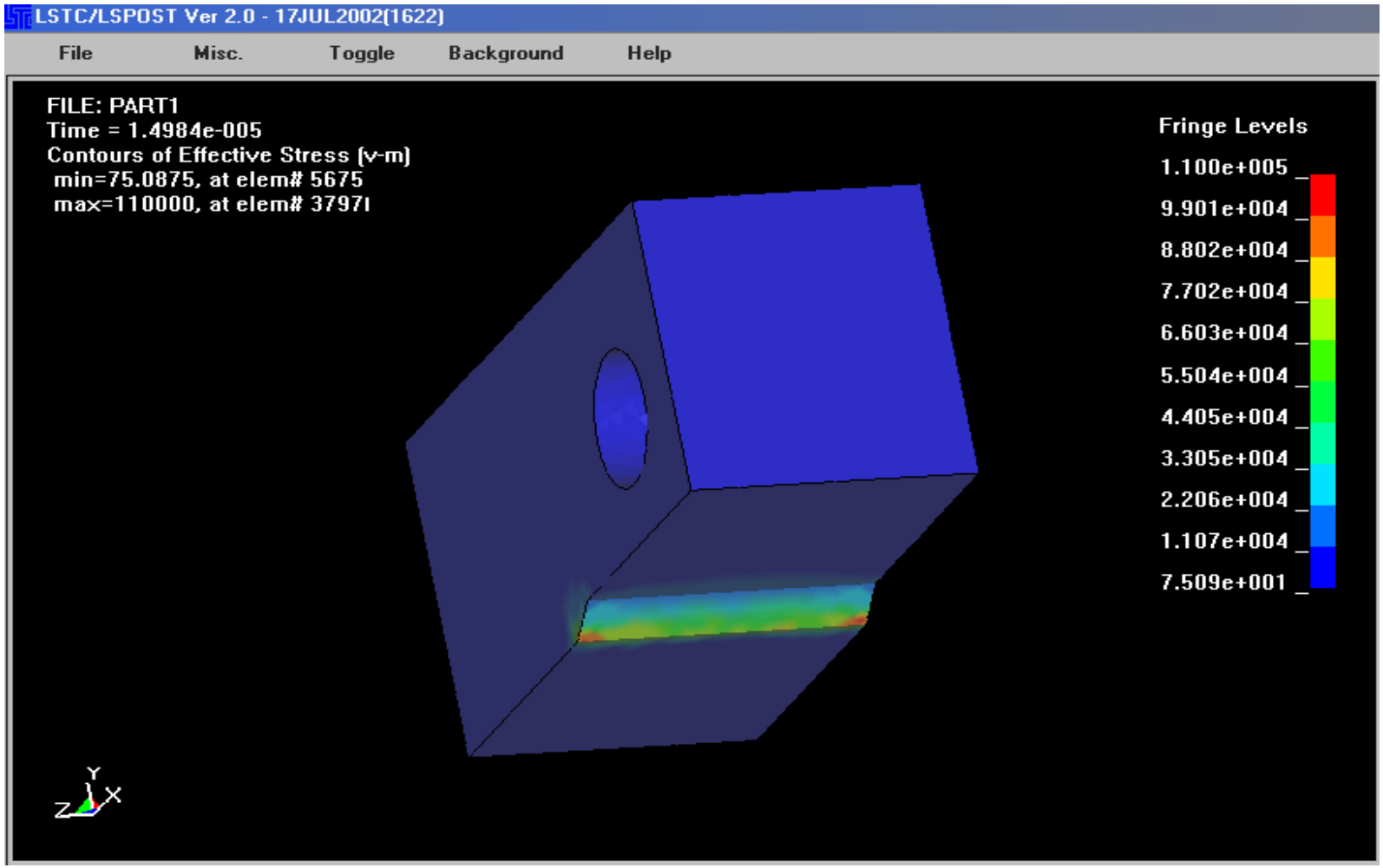
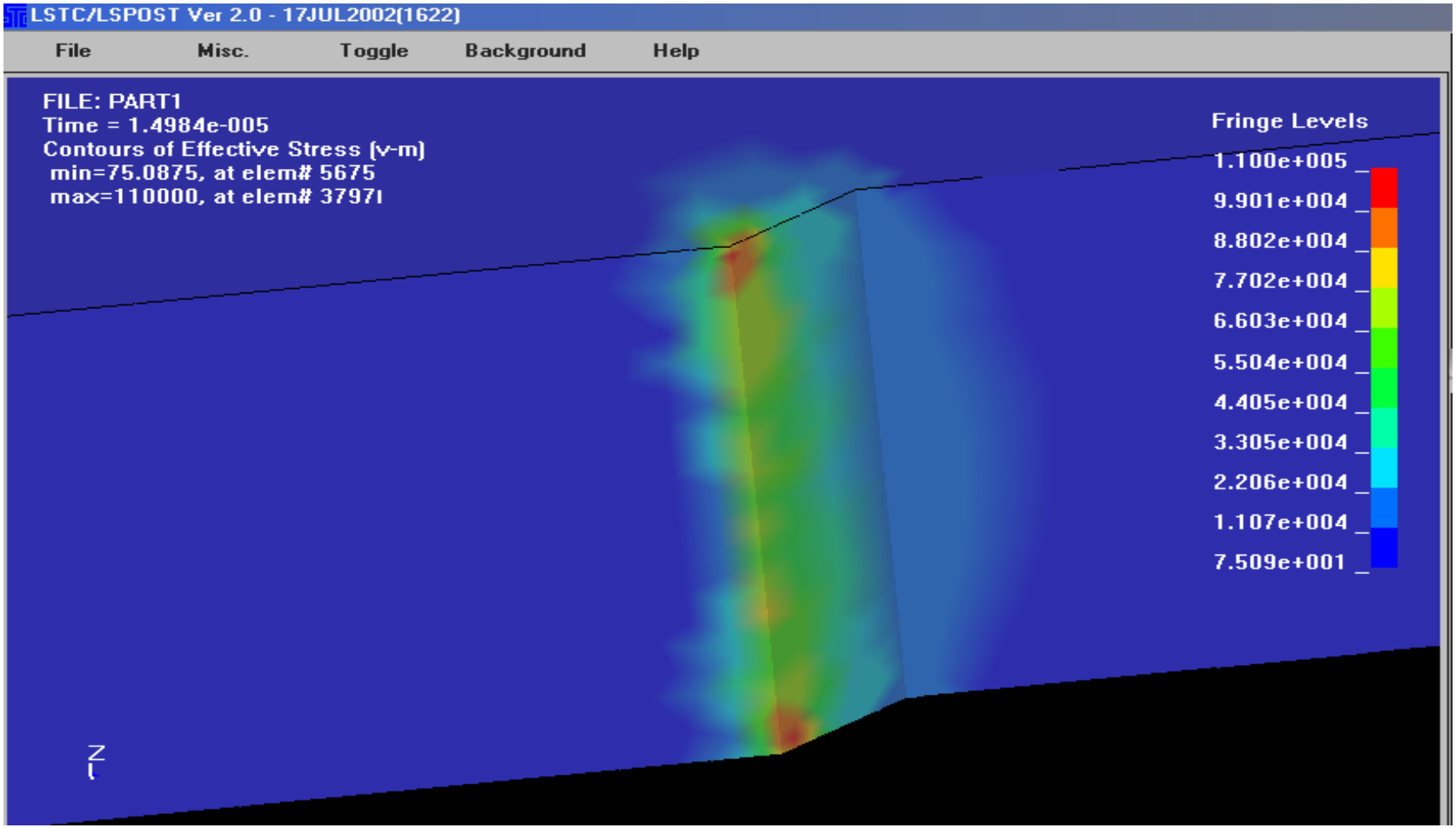


Effective Plastic Strain vs. Time

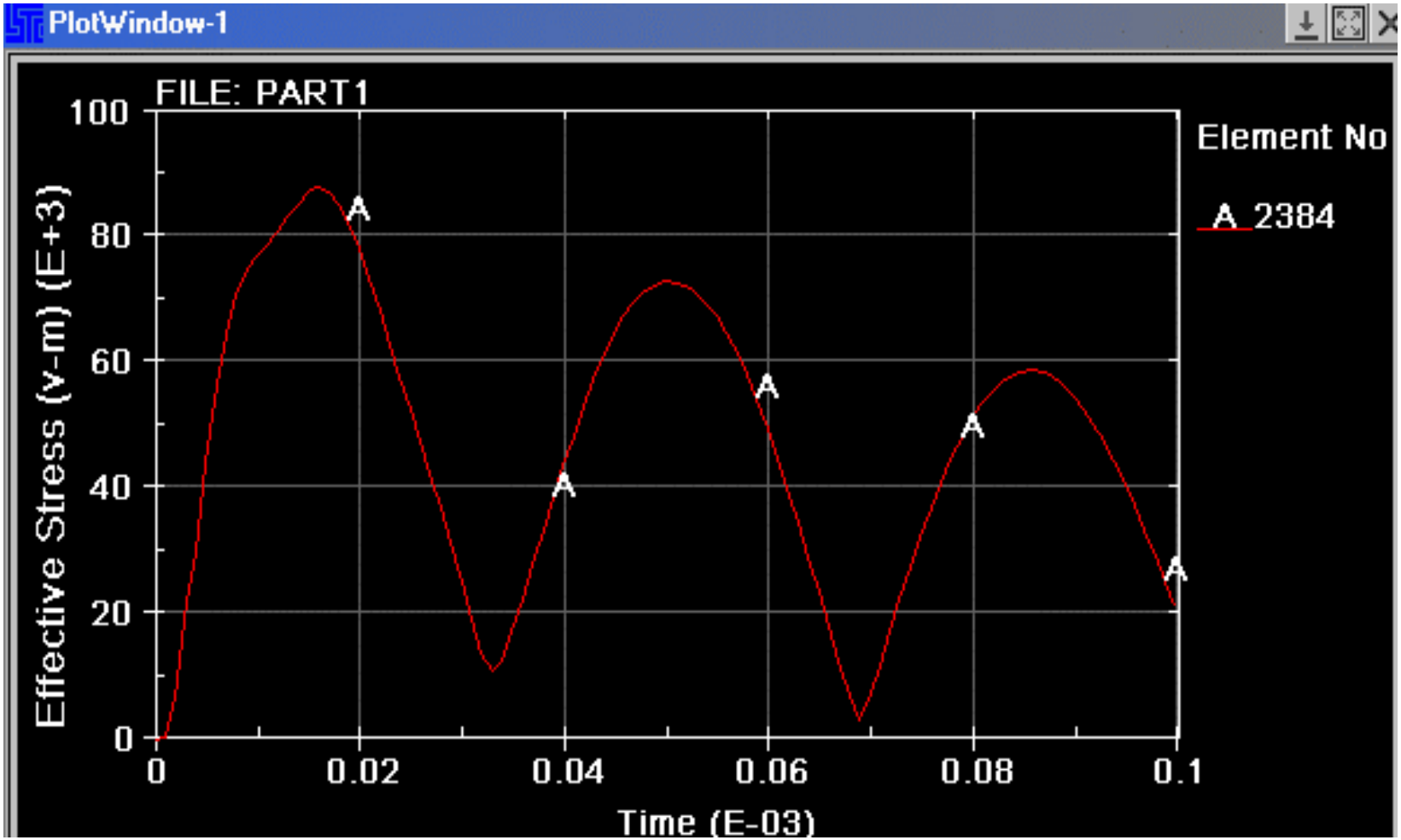


Maximum Stress Contour (Mesh II)

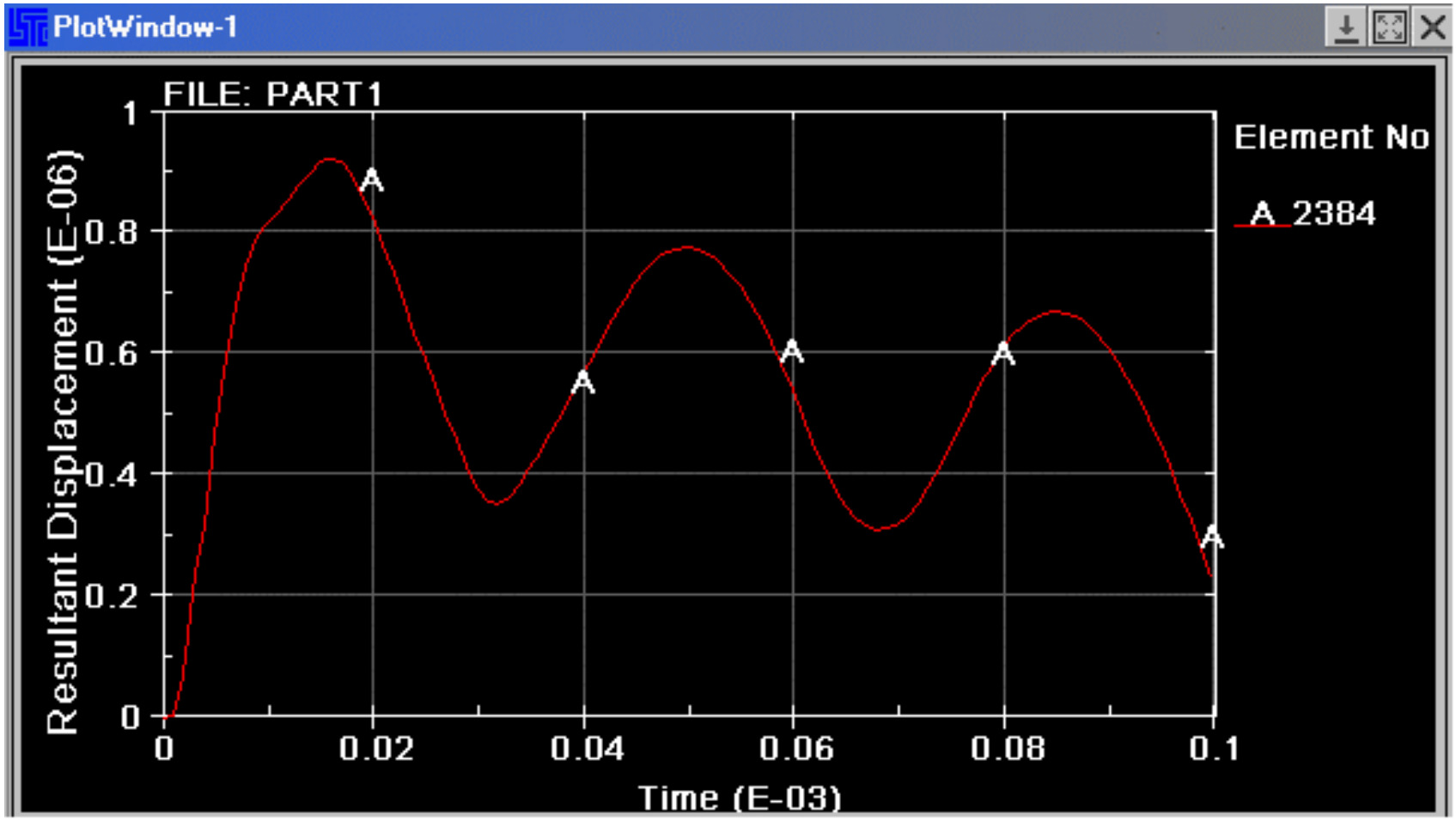
Max. Stress = 110 ksi



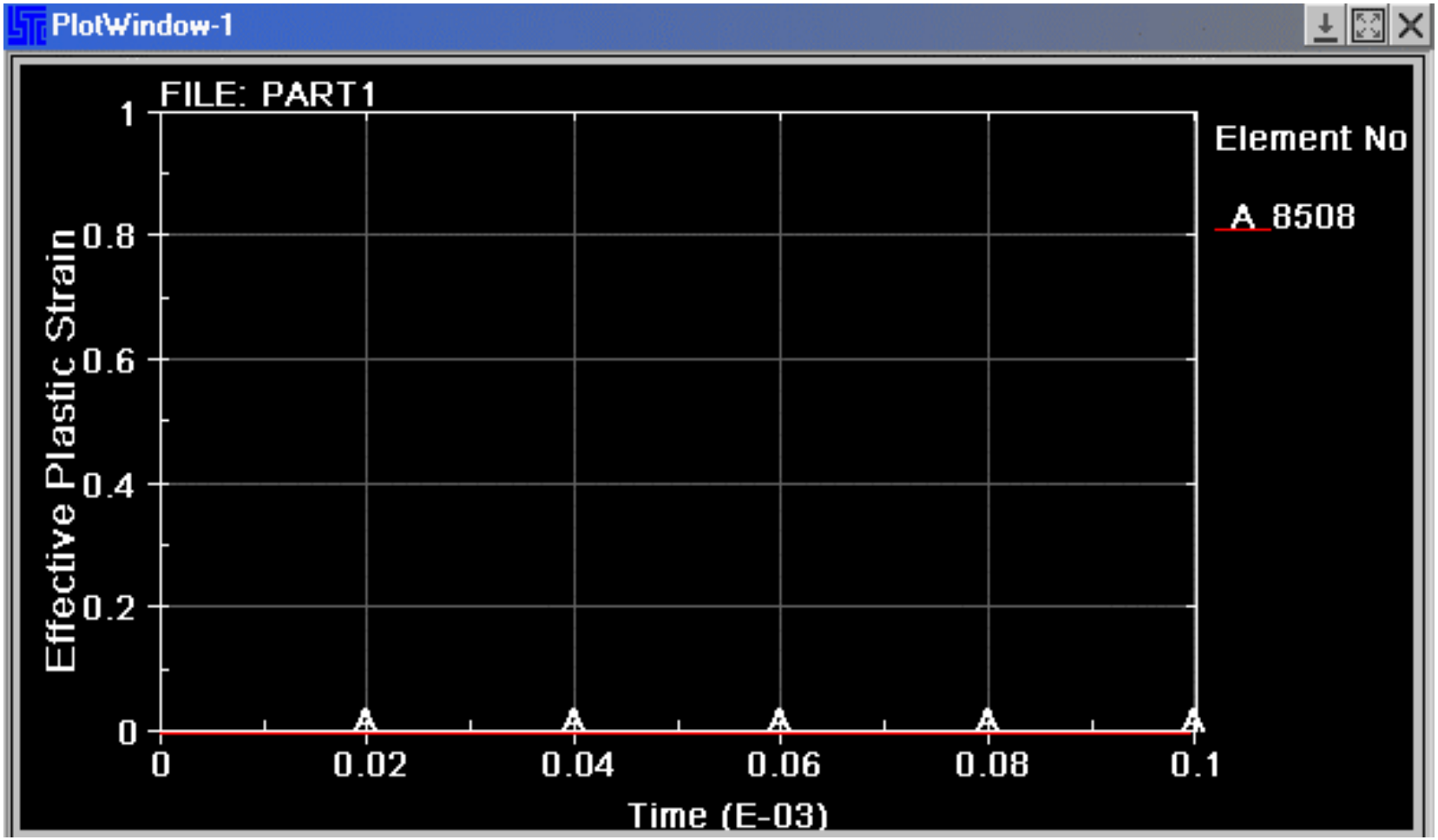
Maximum Stress Contour in the notched region from LS DYNA



Effective Stress vs. Time



Resultant Displacement vs. Time



Effective Plastic Strain vs. Time

Computational Results

Mesh Configuration	EP-823 COMPACT TENSION SPECIMEN	
	No. of Nodes	CPU Time
I	1662	85
II	2692	274

Comparison of No. of nodes and CPU time

MATERIAL	CONFIGURATION	MESH SCHEME I (ksi)	MESH SCHEME II (ksi)
EP-823	COMPACT TENSILE	110.0	110.0

Computational values of stress from LS DYNA

MATERIAL	CONFIGURATION	PROJECT I	PROJECT II
EP-823	COMPACT TENSILE	Max. Stress Obtained= 122.2 Ksi (Mesh I) Max. Stress Obtained= 215.4 Ksi (Mesh II)	Max. Stress Obtained= 110.0 Ksi (Mesh I) Max. Stress Obtained= 110.0 Ksi (Mesh II)

Comparison of Computational results from Project I and Project II

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Conclusions

- **The compact tension specimen was studied under different mesh configurations for the evaluation of various parameters resulting from an application of a chosen initial velocity.**

- **Comparitive analysis was performed with the results of computation from the two projects .**

- **Contours were plotted for Effective Stress , Resultant Displacement and Effective Strain.**

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