

# Can Test Report

root

August 10, 2020

This document was generated on 2020-08-10, 10:57:14 with the Automatic Report Generator (ARG) version "develop" on the Linux system `runner-z3wu8uu-project-18732201-concurrent-0`.

## **Abstract**

This report is about the numerical simulation of a crushed can.

# Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>2</b>	<b>The Can Case</b>	<b>5</b>
2.1	Model Meta-Information . . . . .	5
2.2	Mesh Blocks . . . . .	6
2.3	Visualizations of Some Available Attributes . . . . .	11
2.3.1	Surface Renderings of Initial State . . . . .	11
2.3.2	Surface Renderings at Intermediate Time Step . . . . .	11
2.3.3	Surface Renderings of Final State . . . . .	12
<b>3</b>	<b>Results</b>	<b>14</b>
3.1	Quantities of Interest; Margins . . . . .	14

# List of Figures

2.1	Perspective (top left) and parallel (top right: <b>XY</b> ; bottom left: <b>YZ</b> ; bottom right: <b>XZ</b> ) rendering of <b>block 1</b> . . . . .	7
2.2	Histogram of shape element quality in block <b>Unnamed block ID: 1</b> . . . . .	8
2.3	Perspective (top left) and parallel (top right: <b>XY</b> ; bottom left: <b>YZ</b> ; bottom right: <b>XZ</b> ) rendering of <b>block 2</b> . . . . .	9
2.4	Translucent surface rendering of <b>can.ex2</b> at time step 0. . . . .	11
2.5	Translucent surface rendering of <b>can.ex2</b> at time step 0. . . . .	11
2.6	Translucent surface rendering of <b>can.ex2</b> at time step 21. . . . .	12
2.7	Translucent surface rendering of <b>can.ex2</b> at time step 21. . . . .	12
2.8	Translucent surface rendering of <b>can.ex2</b> at time step 43. . . . .	13
2.9	Translucent surface rendering of <b>can.ex2</b> at time step 43. . . . .	13

# List of Tables

2.1	Topological properties of <code>can.ex2</code> . . . . .	5
2.2	Element blocks of <code>can.ex2</code> . . . . .	5
2.3	Node sets of <code>can.ex2</code> . . . . .	5
2.4	Side sets of <code>can.ex2</code> . . . . .	6
2.5	Variables of <code>can.ex2</code> . . . . .	6
2.6	Properties of block <code>Unnamed block ID: 1.</code> . . . . .	7
2.7	Element quality statistics of block <code>Unnamed block ID: 1.</code> . . . . .	8
2.8	Properties of block <code>Unnamed block ID: 2.</code> . . . . .	9
2.9	Element quality statistics of block <code>Unnamed block ID: 2.</code> . . . . .	10

# Chapter 1

## Introduction

This sample report illustrates the automatic report generator (ARG).

We simply recall that the *equivalent plastic strain rate* is defined as follows:

$$\dot{\epsilon} = \sqrt{\frac{2}{3} \dot{\epsilon}_{ij}^p \dot{\epsilon}_{ij}^p},$$

where  $\dot{\epsilon}_{ij}^p$  is the *plastic strain rate*.

## Chapter 2

# The Can Case

### 2.1 Model Meta-Information

This section provides an overview of the data set used for this analysis.

item	number
Exodus II files	1
element blocks	2
element fields	1
elements	7152
node fields	3
node sets	2
nodes	10088
side sets	1
time-steps	44

Table 2.1: Topological properties of `can.ex2`

block ID	block name
1	Unnamed block ID: 1
2	Unnamed block ID: 2

Table 2.2: Element blocks of `can.ex2`

node set ID	node set name
1	Unnamed set ID: 1
100	Unnamed set ID: 100

Table 2.3: Node sets of `can.ex2`



side set ID	side set name
4	Unnamed set ID: 4

Table 2.4: Side sets of `can.ex2`

variable	type
ACCL	NODAL
DISPL	NODAL
VEL	NODAL
EQPS	ELEMENT
KE	GLOBAL
NSTEPS	GLOBAL
TMSTEP	GLOBAL
XMOM	GLOBAL
YMOM	GLOBAL
ZMOM	GLOBAL

Table 2.5: Variables of `can.ex2`

## 2.2 Mesh Blocks

This section provides a description of all blocks contained in the mesh `mesh/crush_assembly.g`.

Block 1 (Unnamed block ID: 1) summary

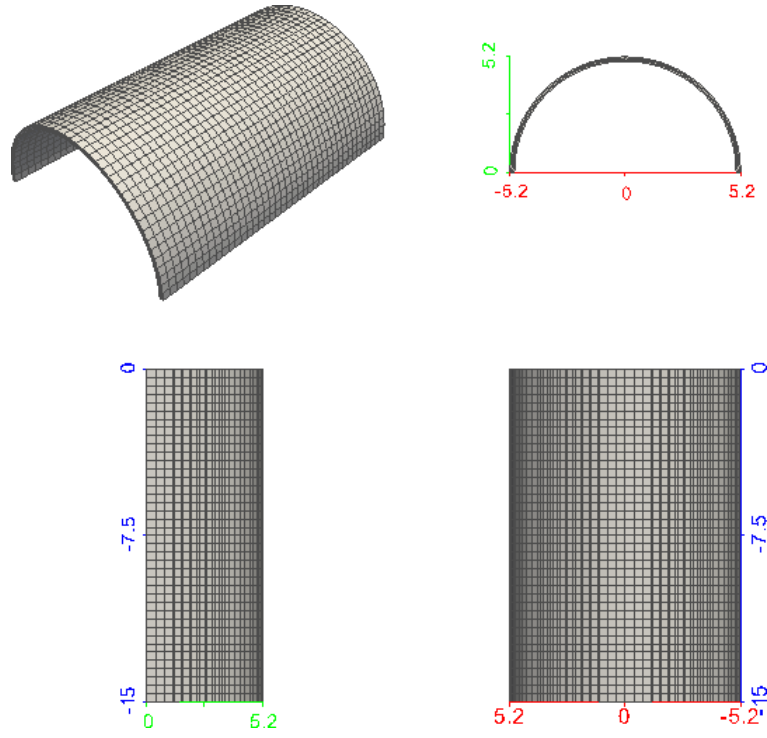


Figure 2.1: Perspective (top left) and parallel (top right:  $XY$ ; bottom left:  $YZ$ ; bottom right:  $XZ$ ) rendering of block 1.

property	value
number of nodes	6724
number of elements	4800
type of first element in block	HEX8

Table 2.6: Properties of block Unnamed block ID: 1.

Block 1 (Unnamed block ID: 1) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.9992	0.9992	0.9992	0	0
shape	0.4525	0.4549	0.4572	0.00188	0.004134

Table 2.7: Element quality statistics of block **Unnamed block ID: 1**.

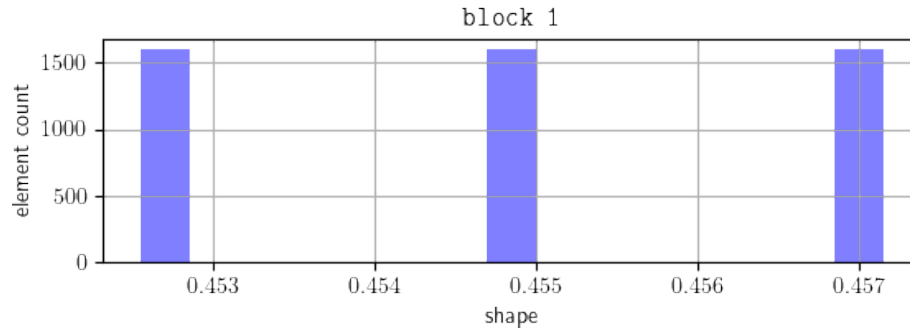


Figure 2.2: Histogram of shape element quality in block **Unnamed block ID: 1**.

**Comment by Author:** Comment by author: This block represents one half of a can.

Block 2 (Unnamed block ID: 2) summary

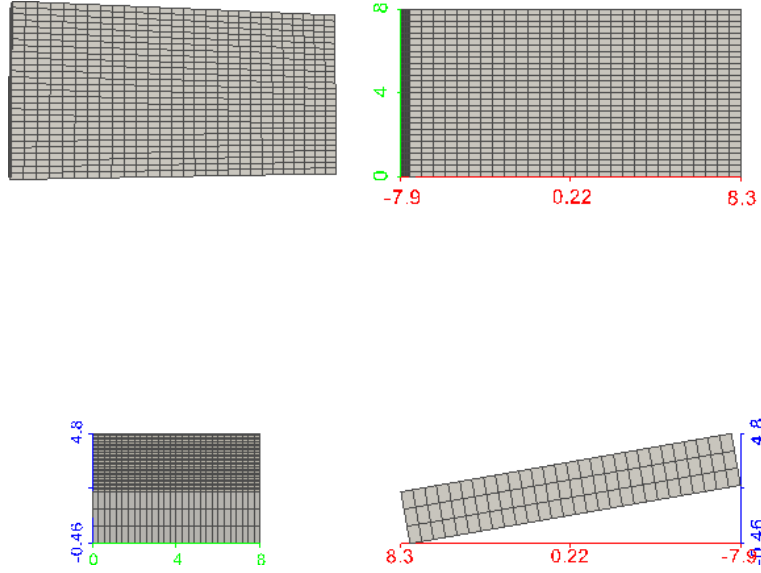


Figure 2.3: Perspective (top left) and parallel (top right:  $XY$ ; bottom left:  $YZ$ ; bottom right:  $XZ$ ) rendering of block 2.

property	value
number of nodes	3364
number of elements	2352
type of first element in block	HEX8

Table 2.8: Properties of block Unnamed block ID: 2.

Block 2 (Unnamed block ID: 2) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	1	1	1	0	0
shape	0.7197	0.7197	0.7197	2.148e-07	2.984e-07

Table 2.9: Element quality statistics of block **Unnamed block ID: 2**.

Other note: This block represents a crushing plate.

## 2.3 Visualizations of Some Available Attributes

### 2.3.1 Surface Renderings of Initial State

We begin by presenting some surface renderings of the data set for several of its scalar or vector attributes, at the initial time step  $t = 0$ .

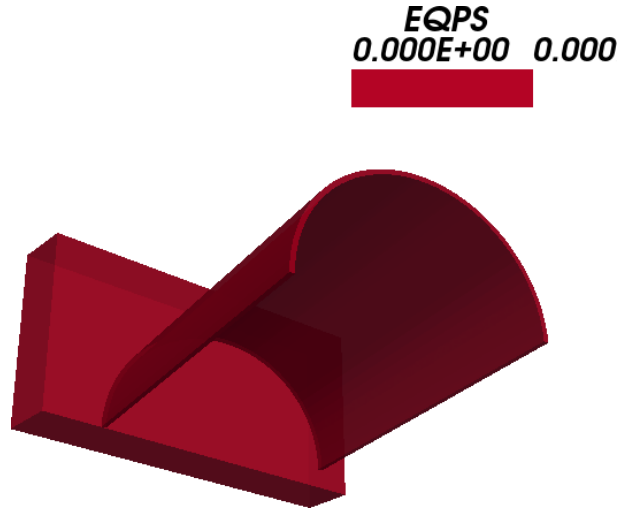


Figure 2.4: Translucent surface rendering of `can.ex2` at time step 0.

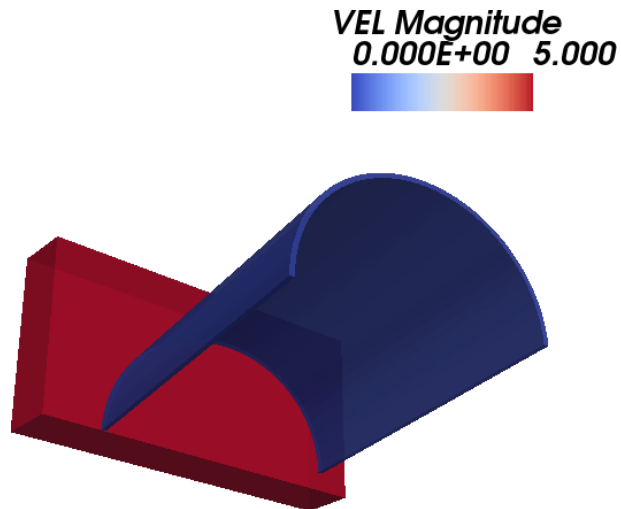


Figure 2.5: Translucent surface rendering of `can.ex2` at time step 0.

### 2.3.2 Surface Renderings at Intermediate Time Step

We continue with some depictions of the same data set, half-way through the simulation.

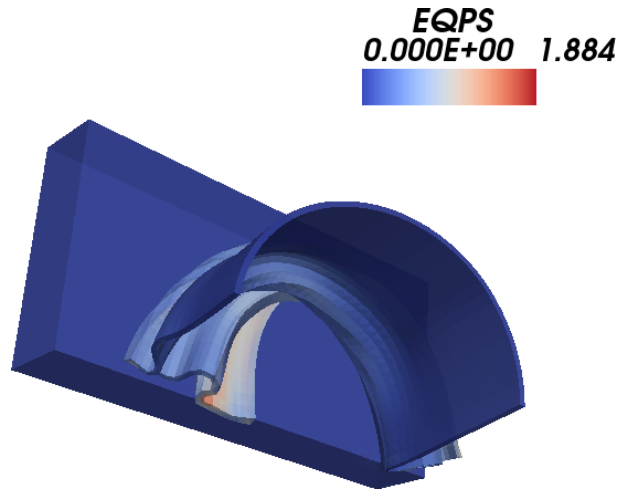


Figure 2.6: Translucent surface rendering of `can.ex2` at time step 21.

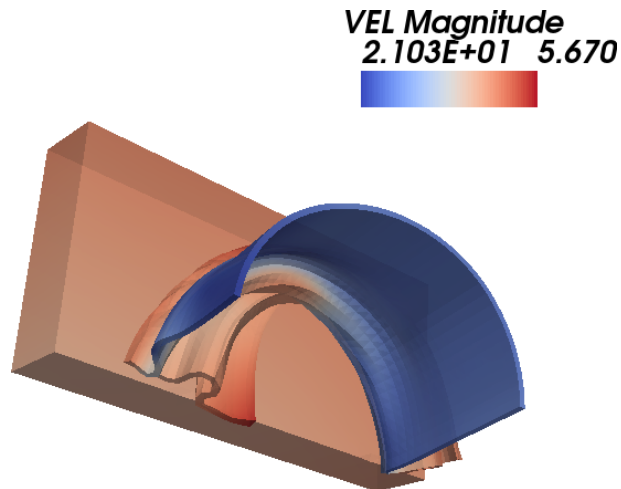


Figure 2.7: Translucent surface rendering of `can.ex2` at time step 21.

### 2.3.3 Surface Renderings of Final State

We conclude with renditions of the final state of the simulation.

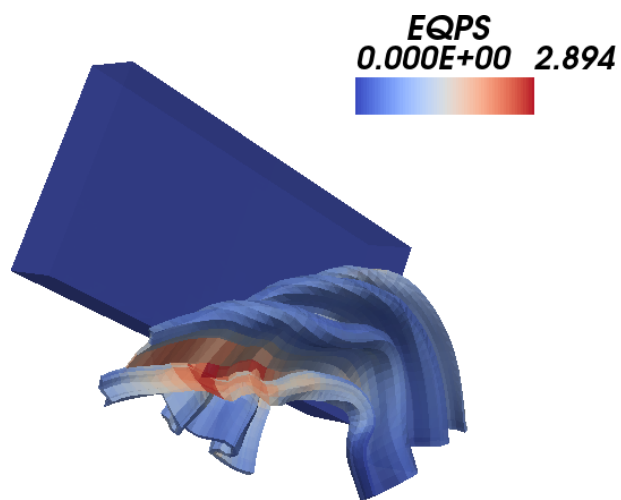


Figure 2.8: Translucent surface rendering of `can.ex2` at time step 43.

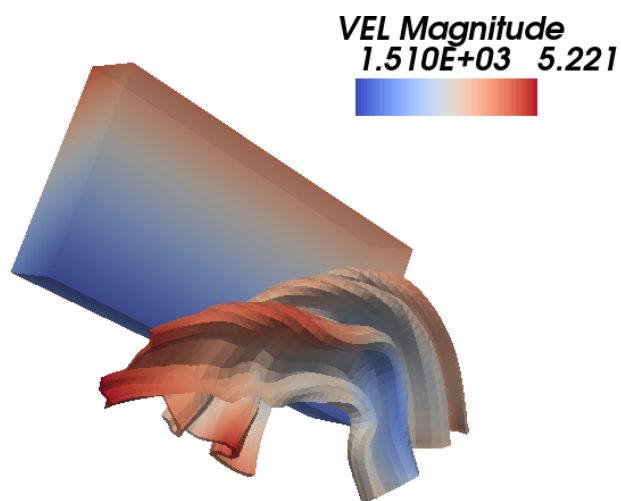


Figure 2.9: Translucent surface rendering of `can.ex2` at time step 43.



# Chapter 3

## Results

This chapter describes key results of the analysis workflow instance.

### 3.1 Quantities of Interest; Margins

#### **Requirements:**

- Tensile yield stress is 20000 psi.
- Required factor of safety is 3.

#### **Calculated Performance:**

- The calculated maximum nodal projected Mises stress is 7904.79 psi.
- The calculated normalized margin of maximum von Mises stress is -0.062.