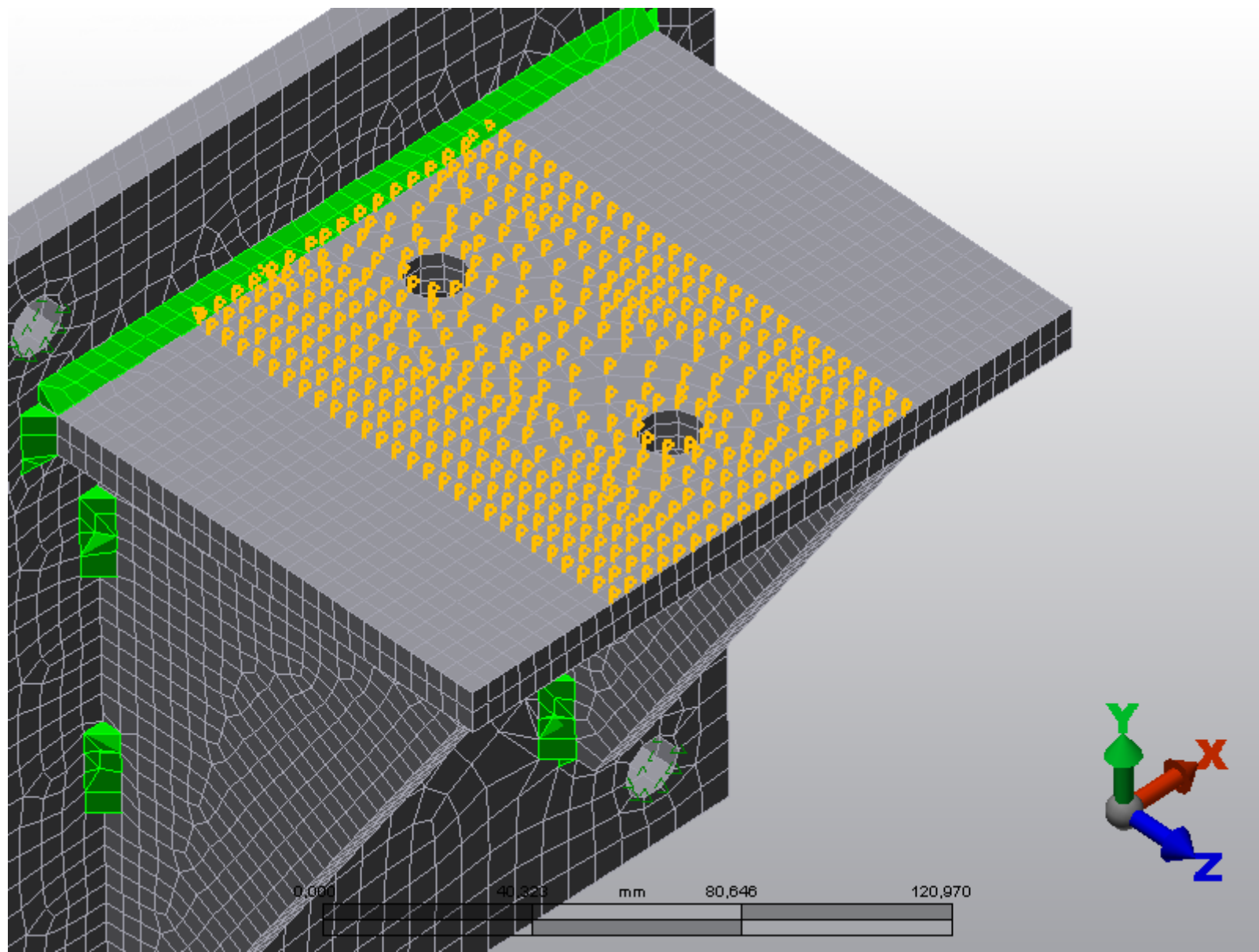




# Design Analysis

## Project Title Here

### Created by

Author:

Department:

Created Date: 09/03/2012

### Reviewed by

Reviewer:

Department:

Model Created 09/03/2012

Date:

Reviewer

Comments:

### Executive Summary

This is where to put your Executive summary. So, replace this text with your overall Project Description.

### Summary

#### *Model Information*

Analysis Type - Static Stress with Linear Material Models

Units - Custom - (N, mm, s, °C, K, V, ohm, A, J)

Model location - C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.fem

Design scenario description - Design Scenario # 1

# Analysis Parameters Information

## Load Case Multipliers

Static Stress with Linear Material Models may have multiple load cases. This allows a model to be analyzed with multiple loads while solving the equations a single time. The following is a list of load case multipliers that were analyzed with this model.

| Load Case | Pressure/Surface Forces | Acceleration/Gravity | Rotation | Angular Acceleration | Displaced Boundary | Thermal | Voltage |
|-----------|-------------------------|----------------------|----------|----------------------|--------------------|---------|---------|
| 1         | 1                       | 0                    | 0        | 0                    | 0                  | 0       | 0       |

## Multiphysics Information

|                                       |            |
|---------------------------------------|------------|
| Default Nodal Temperature             | 0 °C       |
| Source of Initial Nodal Temperatures  | Model file |
| Time step from Heat Transfer Analysis | Last       |
| Default nodal voltage                 | 0 V        |
| Source of nodal voltages              | Model file |

## Processor Information

|                |           |
|----------------|-----------|
| Type of Solver | Automatic |
|----------------|-----------|

|                                           |     |
|-------------------------------------------|-----|
| Disable Calculation and Output of Strains | No  |
| Calculate Reaction Forces                 | Yes |
| Invoke Banded Solver                      | Yes |
| Avoid Bandwidth Minimization              | No  |
| Stop After Stiffness Calculations         | No  |
| Displacement Data in Output File          | No  |
| Stress Data in Output File                | No  |
| Equation Numbers Data in Output File      | No  |
| Element Input Data in Output File         | No  |
| Nodal Input Data in Output File           | No  |
| Centrifugal Load Data in Output File      | No  |

## Part Information

| Part ID           | Part Name | Element Type | Material Name                                       |
|-------------------|-----------|--------------|-----------------------------------------------------|
| <a href="#">1</a> | Part 1    | Brick        | <a href="#">Reinforcing Steel (Medium Strength)</a> |
| <a href="#">2</a> | Part1:1   | Brick        | <a href="#">steel. mild</a>                         |
| <a href="#">3</a> | Part2:1   | Brick        | <a href="#">steel. mild</a>                         |
| <a href="#">4</a> | Part3:1   | Brick        | <a href="#">steel. mild</a>                         |
| <a href="#">5</a> | Part3:2   | Brick        | <a href="#">steel. mild</a>                         |

## Element Information

Element Properties used for:

- Part 1
- Part1:1
- Part2:1
- Part3:1
- Part3:2

|                                   |              |
|-----------------------------------|--------------|
| Element Type                      | Brick        |
| Compatibility                     | Not Enforced |
| Integration Order                 | 2nd Order    |
| Stress Free Reference Temperature | 0 °C         |

## Material Information

Reinforcing Steel (Medium Strength) -Brick

|                      |                                                                      |
|----------------------|----------------------------------------------------------------------|
| Material Model       | Standard                                                             |
| Material Source      | Autodesk Simulation Material Library                                 |
| Material Source File | C:\Program Files\Autodesk\Algor Simulation 2012\matlibs\algormat.mlb |

|                                  |                                        |
|----------------------------------|----------------------------------------|
| Date Last Updated                | 2004/09/30-16:00:00                    |
| Material Description             | None                                   |
| Mass Density                     | 7 N·s <sup>2</sup> /mm/mm <sup>3</sup> |
| Modulus of Elasticity            | 199947 N/mm <sup>2</sup>               |
| Poisson's Ratio                  | 0.32                                   |
| Shear Modulus of Elasticity      | 75842 N/mm <sup>2</sup>                |
| Thermal Coefficient of Expansion | 1 1/°C                                 |

#### steel. mild -Brick

|                             |                                        |
|-----------------------------|----------------------------------------|
| Material Model              | Standard                               |
| Material Source             | Not Applicable                         |
| Material Source File        |                                        |
| Date Last Updated           | 2012/09/03-12:39:06                    |
| Material Description        | Customer defined material properties   |
| Mass Density                | 0 N·s <sup>2</sup> /mm/mm <sup>3</sup> |
| Modulus of Elasticity       | 220000 N/mm <sup>2</sup>               |
| Poisson's Ratio             | 0.275                                  |
| Shear Modulus of Elasticity | 110000, N/mm <sup>2</sup>              |

|                                  |        |
|----------------------------------|--------|
| Thermal Coefficient of Expansion | 0 1/°C |
|----------------------------------|--------|

## Loads

### FEA Object Group 5: Surface Pressure/Tractions

#### Surface Pressure/Traction

| ID | Description | Part ID | Surface ID | Magnitude (N/mm²) | X Magnitude (N/mm²) | Y Magnitude (N/mm²) | Z Magnitude (N/mm²) | Multiplier Table Id | Multiplier | Type     | Follows Displace |
|----|-------------|---------|------------|-------------------|---------------------|---------------------|---------------------|---------------------|------------|----------|------------------|
| 1  | Unnamed     | 3       | 2          | 500,000000        | 0,000000            | 0,000000            | 0,000000            | 1                   | 1,000000   | Pressure | No               |

## Constraints

### FEA Object Group 1: Surface Boundary Conditions

#### Surface Boundary Condition

| ID | Description | Part ID | Surface ID | Tx  | Ty  | Tz  | Rx  | Ry  | Rz  |
|----|-------------|---------|------------|-----|-----|-----|-----|-----|-----|
| 1  | Unnamed     | 2       | 4          | Yes | Yes | Yes | Yes | Yes | Yes |

### FEA Object Group 2: Surface Boundary Conditions

#### Surface Boundary Condition

| ID | Description | Part ID | Surface ID | Tx  | Ty  | Tz  | Rx  | Ry  | Rz  |
|----|-------------|---------|------------|-----|-----|-----|-----|-----|-----|
| 2  | Unnamed     | 2       | 1          | Yes | Yes | Yes | Yes | Yes | Yes |

### FEA Object Group 3: Surface Boundary Conditions

#### Surface Boundary Condition

| ID | Description | Part ID | Surface ID | Tx  | Ty  | Tz  | Rx  | Ry  | Rz  |
|----|-------------|---------|------------|-----|-----|-----|-----|-----|-----|
| 3  | Unnamed     | 2       | 3          | Yes | Yes | Yes | Yes | Yes | Yes |

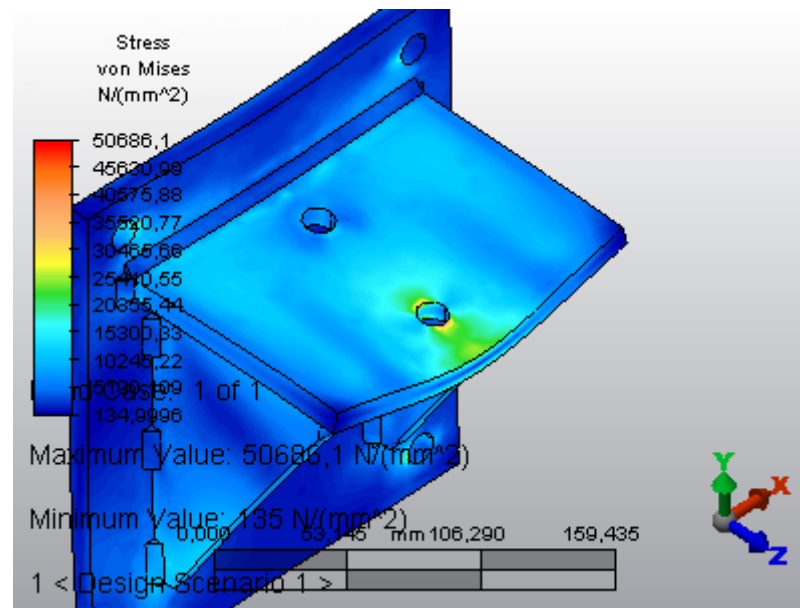
### FEA Object Group 4: Surface Boundary Conditions

#### Surface Boundary Condition

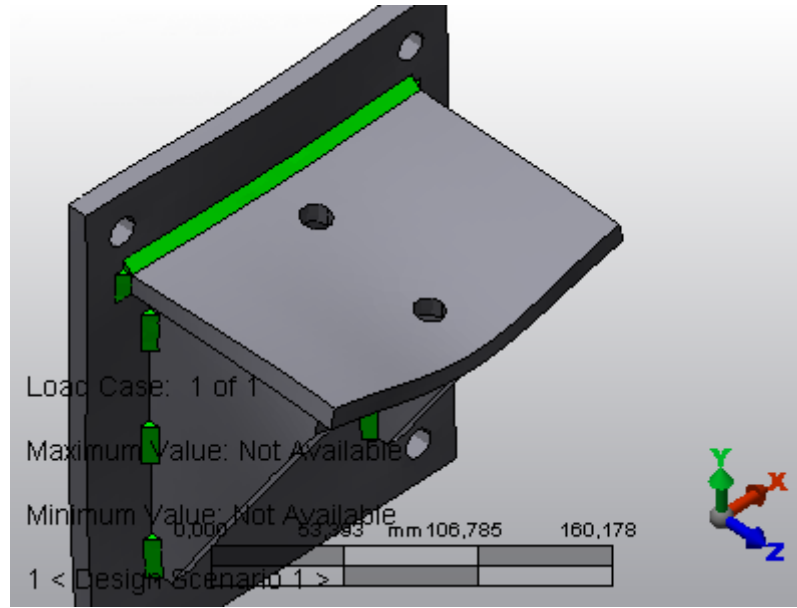
| ID | Description | Part ID | Surface ID | Tx  | Ty  | Tz  | Rx  | Ry  | Rz  |
|----|-------------|---------|------------|-----|-----|-----|-----|-----|-----|
| 4  | Unnamed     | 2       | 2          | Yes | Yes | Yes | Yes | Yes | Yes |

## Results Presentation Images

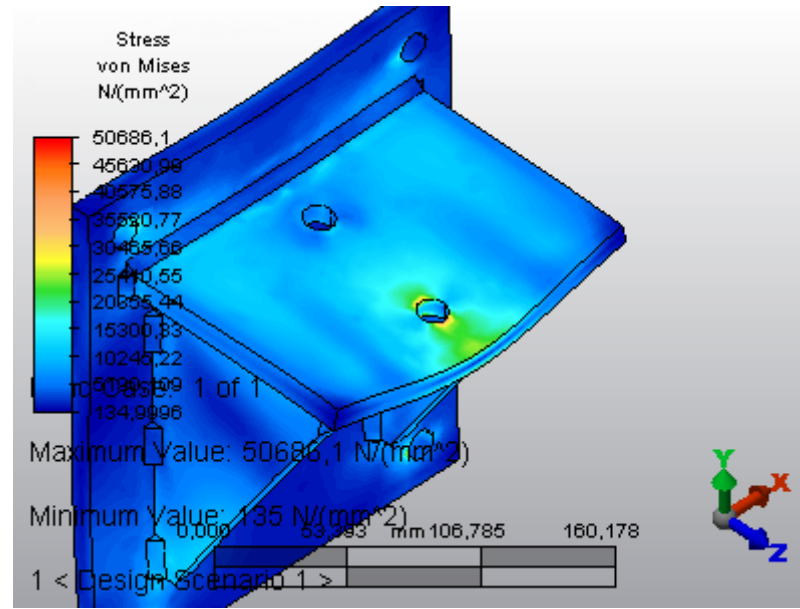
*Stress*



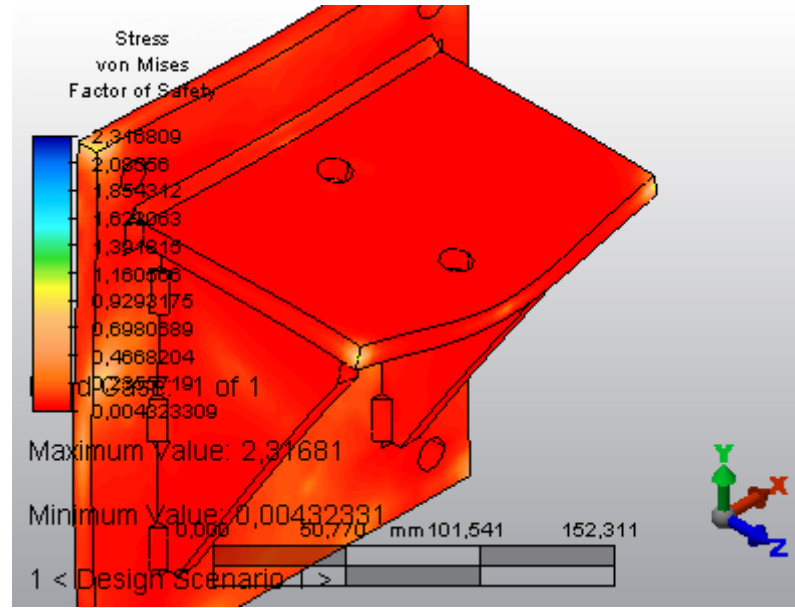
*Deformed Shape*



## ***Stress***



*Displacement*



## Processor Log Files

### Summary Logs

Autodesk (R) Simulation Static Stress with Linear Material Models  
Version 2012.00.00.0163-W64/X64 04-Mar-2011  
Copyright (c) 2011, Autodesk, Inc. All rights reserved.

\*\*\*\* Memory Dynamically Allocated = 1993656 KB

\*\*\*\* Model Unit System Settings:

-----  
Unit System : Custom  
Force : N  
Length : mm  
Time : s  
Temperature (Absolute) : deg C (K)  
Thermal Energy : J  
Voltage : V  
Current : A  
Electrical Resistance : ohm  
Mass : N\*s^2/mm  
-----

-----  
DATE: MARCH 9, 2012

TIME: 12:47 PM

INPUT MODEL: C:\Users\user\Documents\Inventor\Support  
Bracket\Assembly1.ds\_data\1\ds

PROGRAM VERSION: 201200000163  
alg-win-x64.dll VERSION: 201200000163  
agsdb\_ar-win-x64.dll VERSION: 201200000163  
algconfig-win-x64.dll VERSION: 201200000163  
algsolve.exe VERSION: 201200000163  
amgsolve.exe VERSION: 360000000

-----  
Structural

1\*\*\*\* CONTROL INFORMATION

number of node points (NUMNP) = 12485

|                             |          |   |            |
|-----------------------------|----------|---|------------|
| number of element types     | (NELTYP) | = | 5          |
| number of load cases        | (LL)     | = | 1          |
| number of frequencies       | (NF)     | = | 0          |
| analysis type code          | (NDYN)   | = | 0          |
| equations per block         | (KEQB)   | = | 0          |
| bandwidth minimization flag | (MINBND) | = | -1         |
| gravitational constant      | (GRAV)   | = | 9.8146E+03 |
| number of equations         | (NEQ)    | = | 37239      |

\*\*\*\* PRINT OF NODAL DATA SUPPRESSED

\*\*\*\* PRINT OF EQUATION NUMBERS SUPPRESSED

\*\*\*\* Hard disk file size information for processor:

Available hard disk space on current drive = 45463.508 megabytes

Gravity direction vector = 0.0000E+00 0.0000E+00 -1.0000E+00

1\*\*\*\* ELEMENT LOAD MULTIPLIERS

| load case | case A    | case B    | case C    | case D    | case E    |
|-----------|-----------|-----------|-----------|-----------|-----------|
| 1         | 1.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

Centrifugal force / angular acceleration

| load case | rot.rate  | ang.acc.  |
|-----------|-----------|-----------|
| 1         | 0.000E+00 | 0.000E+00 |

\*\*\*\* Invoking Parallel BCSLIB-EXT Sparse Solver...

\*\*\*\* Number of equations = 37239  
Estimated maximum bandwidth = 1150  
Estimated triangle matrix nonzeroes = 5347224

\*\*\*\* Symbolic Assembling Using the Row-Hits Matrix Profile ...  
\*\*\*\* Assembled in One Block.  
\*\*\*\* Real Sparse Matrix Assembly ...

1\*\*\*\* STIFFNESS MATRIX PARAMETERS

|                                     |            |
|-------------------------------------|------------|
| minimum non-zero diagonal element = | 1.8050E+05 |
| maximum diagonal element =          | 1.0663E+08 |
| maximum/minimum =                   | 5.9076E+02 |
| average diagonal element =          | 2.3529E+06 |

the minimum is found at equation 9740: node=3319 Ty  
the maximum is found at equation 29292: node=9836 Tz

in the upper off-diagonal matrix:  
number of entries in the profile = 5309985  
number of symbolic nonzeros = 1078518  
number of real nonzeros = 1078508

\*\*\*\* Sparse Matrix Assembled in One Block

\*\*\*\* Load Cases 1

BCSLIB-EXT solver memory status:

|                                   |         |
|-----------------------------------|---------|
| in-core memory requirement (MB) = | 105.91  |
| minimum memory requirement (MB) = | 22.58   |
| user specified memory (MB) =      | 961.77  |
| available physical memory (MB) =  | 961.77  |
| available virtual memory (MB) =   | 4684.82 |
| memory currently allocated (MB) = | 105.91  |

\*\*\*\* End Sparse Solver Solution

# Reaction Sums and Maxima for Load Case 1

Sum of applied forces

| X-Force     | Y-Force     | Z-Force    | X-Moment   | Y-Moment   | Z-Moment   |
|-------------|-------------|------------|------------|------------|------------|
| -1.8879E-10 | -4.5360E+06 | 1.4544E-09 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Sum of reactions

| X-Force    | Y-Force    | Z-Force    | X-Moment   | Y-Moment   | Z-Moment   |
|------------|------------|------------|------------|------------|------------|
| 2.5256E-07 | 2.9441E-07 | 8.0541E-07 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Sum of residuals

| X-Force    | Y-Force     | Z-Force    | X-Moment   | Y-Moment   | Z-Moment   |
|------------|-------------|------------|------------|------------|------------|
| 2.5247E-07 | -4.5360E+06 | 8.0678E-07 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Sum of unfixed direction residuals

| X-Force    | Y-Force     | Z-Force    | X-Moment   | Y-Moment   | Z-Moment   |
|------------|-------------|------------|------------|------------|------------|
| 5.3308E-08 | -4.2086E-07 | 1.0434E-06 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Largest applied forces and moments

| Node        | Node        | Node       | Node       | Node       | Node       |
|-------------|-------------|------------|------------|------------|------------|
| X-Force     | Y-Force     | Z-Force    | X-Moment   | Y-Moment   | Z-Moment   |
| 3872        | 4073        | 4148       | 0          | 0          | 0          |
| -1.2401E-11 | -2.9488E+04 | 1.4879E-11 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Largest nodal reactions

| Node        | Node        | Node        | Node       | Node       | Node       |
|-------------|-------------|-------------|------------|------------|------------|
| X-Force     | Y-Force     | Z-Force     | X-Moment   | Y-Moment   | Z-Moment   |
| 897         | 890         | 917         | 0          | 0          | 0          |
| -2.3005E+05 | -3.4790E+05 | -2.5578E+05 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Largest nodal residuals

| Node        | Node        | Node        | Node       | Node       | Node       |
|-------------|-------------|-------------|------------|------------|------------|
| X-Force     | Y-Force     | Z-Force     | X-Moment   | Y-Moment   | Z-Moment   |
| 897         | 890         | 917         | 0          | 0          | 0          |
| -2.3005E+05 | -3.4790E+05 | -2.5578E+05 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

Largest unfixed direction residuals

| Node        | Node        | Node        | Node       | Node       | Node       |
|-------------|-------------|-------------|------------|------------|------------|
| X-Force     | Y-Force     | Z-Force     | X-Moment   | Y-Moment   | Z-Moment   |
| 7235        | 11262       | 9327        | 0          | 0          | 0          |
| -4.7212E-08 | -2.7165E-07 | -2.0796E-07 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |

1\*\*\*\* TEMPORARY FILE STORAGE (MEGABYTES)

```

-----
UNIT NO.  7 :      0.284
UNIT NO.  8 :      0.429
UNIT NO.  9 :      0.000
UNIT NO. 10 :      0.000
UNIT NO. 11 :      0.000
UNIT NO. 12 :      0.284
UNIT NO. 13 :      0.284
UNIT NO. 14 :      0.000
UNIT NO. 15 :      0.000
UNIT NO. 17 :      0.000
UNIT NO. 51 :      2.483
UNIT NO. 52 :     76.505
UNIT NO. 54 :      0.142
UNIT NO. 55 :      3.972
UNIT NO. 56 :      7.944
UNIT NO. 58 :      0.284
UNIT NO. 59 :      0.000

```

TOTAL : 92.612 Megabytes

## Analysis Logs

Autodesk (R) Simulation Static Stress with Linear Material Models  
Version 2012.00.00.0163-W64/X64 04-Mar-2011  
Copyright (c) 2011, Autodesk, Inc. All rights reserved.

Structural

12485 5 1 0 0 0

\*\*\*\* Linear stress analysis

\*\*\*\* Memory Dynamically Allocated = 1993656 KB

Options executed are:

NOMIN  
STRAIN  
SPARSE  
SUPCNF  
SUPELM  
SUPNOD  
REAC  
ENOR

processing ...

\*\*\*\* Model Unit System Settings:

-----  
Unit System : Custom

|                        |             |
|------------------------|-------------|
| Force                  | : N         |
| Length                 | : mm        |
| Time                   | : s         |
| Temperature (Absolute) | : deg C (K) |
| Thermal Energy         | : J         |
| Voltage                | : V         |
| Current                | : A         |
| Electrical Resistance  | : ohm       |
| Mass                   | : N*s^2/mm  |

-----

\*\*\*\* OPENING TEMPORARY FILES  
NDYN = 0

DATE: MARCH 9, 2012

TIME: 12:47 PM

INPUT MODEL: C:\Users\user\Documents\Inventor\Support  
Bracket\Assembly1.ds\_data\1\ds

PROGRAM VERSION: 201200000163  
alg-win-x64.dll VERSION: 201200000163  
agsdb\_ar-win-x64.dll VERSION: 201200000163  
algconfig-win-x64.dll VERSION: 201200000163  
algsolve.exe VERSION: 201200000163  
amgsolve.exe VERSION: 360000000

\*\*\*\* BEGIN NODAL DATA INPUT  
12485 NODES

37239 DOFS

\*\*\*\* END NODAL DATA INPUT

\*\*\*\* Begin brick element (TYPE-8) data input

```
**** Part          1 containing          2844 elements

**** End input of element part          1

**** Begin brick element (TYPE-8) data input
**** Part          2 containing          9794 elements
          6000 (61.%) elements
          3000 (30.%) elements
           0 ( 0.%) elements

**** End input of element part          2

**** Begin brick element (TYPE-8) data input
**** Part          3 containing          5608 elements
          0 ( 0.%) elements

**** End input of element part          3

**** Begin brick element (TYPE-8) data input
**** Part          4 containing          1065 elements

**** End input of element part          4

**** Begin brick element (TYPE-8) data input
**** Part          5 containing          1029 elements

**** End input of element part          5

**** Hard disk file size information for processor:

        Available hard disk space on current drive = 45463.508 megabytes
```

```
**** BEGIN LOAD INPUT

Gravity direction vector = 0.0000E+00 0.0000E+00 -1.0000E+00
One load case in 13 blocks.
Load factor = 1.00E+00 in the 1st basket in load case 1
**** END LOAD INPUT

**** Invoking Parallel BCSLIB-EXT Sparse Solver...
**** Number of equations = 37239
Estimated maximum bandwidth = 1150
Estimated triangle matrix nonzeros = 5347224

**** Symbolic Assembling Using the Row-Hits Matrix Profile ...
**** Assembled in One Block.
**** Real Sparse Matrix Assembly ...
in the upper off-diagonal matrix:
number of entries in the profile = 5309985
number of symbolic nonzeros      = 1078518
number of real nonzeros          = 1078508
**** Sparse Matrix Assembled in One Block

**** Load Cases 1
**** End Sparse Solver Solution

**** BEGIN DISPLACEMENT OUTPUT
**** PRINT OF DISPLACEMENT OUTPUT SUPPRESSED
**** END DISPLACEMENT OUTPUT
**** BEGINNING REACTION COMPUTATIONS
**** LOADCASES REMAINING      1
**** BLOCKS REMAINING         1
**** PARTS REMAINING          5
**** ELEMENT/GLOBAL CONTRIBUTIONS Part = 1
THE 1st PART CONTAINING 2844 ELEMENTS
```

\*\*\*\* PARTS REMAINING           4  
\*\*\*\* ELEMENT/GLOBAL CONTRIBUTIONS Part = 2  
THE 2nd PART CONTAINING 9794 ELEMENTS

\*\*\*\* PARTS REMAINING           3  
\*\*\*\* ELEMENT/GLOBAL CONTRIBUTIONS Part = 3  
THE 3rd PART CONTAINING 5608 ELEMENTS

\*\*\*\* PARTS REMAINING           2  
\*\*\*\* ELEMENT/GLOBAL CONTRIBUTIONS Part = 4  
THE 4th PART CONTAINING 1065 ELEMENTS

\*\*\*\* PARTS REMAINING           1  
\*\*\*\* ELEMENT/GLOBAL CONTRIBUTIONS Part = 5  
THE 5th PART CONTAINING 1029 ELEMENTS

\*\*\*\* ENDING REACTION COMPUTATIONS

|        |   |           |           |
|--------|---|-----------|-----------|
| ds.t7  | = | 291.078   | kilobytes |
| ds.t8  | = | 439.031   | kilobytes |
| ds.t9  | = | 0.000     | kilobytes |
| ds.t10 | = | 0.000     | kilobytes |
| ds.t11 | = | 0.312     | kilobytes |
| ds.t12 | = | 290.930   | kilobytes |
| ds.t13 | = | 291.078   | kilobytes |
| ds.t14 | = | 0.000     | kilobytes |
| ds.t15 | = | 0.000     | kilobytes |
| ds.t17 | = | 0.000     | kilobytes |
| ds.t51 | = | 2542.500  | kilobytes |
| ds.t52 | = | 78340.781 | kilobytes |
| ds.t54 | = | 145.488   | kilobytes |
| ds.t55 | = | 4067.457  | kilobytes |

```
ds.t56   =      8134.914 kilobytes
ds.t58   =      290.930 kilobytes
ds.t59   =        0.000 kilobytes
```

```
total temporary disk storage (megabytes) = 92.612
```

```
ds.l     =        7.470 kilobytes
ds.do    =      585.281 kilobytes
```

```
**** BEGIN DELETING TEMPORARY FILES
```

```
Processing completed for model:
```

```
[C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.ds_data\1\ds]
```

```
**** TEMPORARY FILES DELETED
```

```
**** END OF SUCCESSFUL EXECUTION
```

```
**** Total actual hard disk space used      =      93.191 megabytes
```

```
Sub-total elapsed time                      =      0.296 minutes
```

```
Autodesk (R) Simulation Stress Calculation Utility
Version 2012.00.00.0163-W64/X64 04-Mar-2011
Copyright (c) 2011, Autodesk, Inc. All rights reserved.
```

```
**** Memory Dynamically Allocated = 1993656 KB
```

```
DATE: MARCH 9, 2012
```

```
TIME: 12:47 PM
```

```
INPUT.....C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.ds_data\1\ds
```

\*\*\*\* Model Unit System Settings:

```
-----  
Unit System           : Custom  
Force                 : N  
Length                : mm  
Time                  : s  
Temperature (Absolute) : deg C (K)  
Thermal Energy        : J  
Voltage               : V  
Current               : A  
Electrical Resistance : ohm  
Mass                  : N*s^2/mm  
-----
```

\*\*\*\* BEGIN TYPE-8 data INPUT  
PART 1 CONTAINING 2844 ELEMENTS

\*\*\*\* END TYPE-8 data INPUT

\*\*\*\* BEGIN TYPE-8 data INPUT  
PART 2 CONTAINING 9794 ELEMENTS  
0 ( 0.%) elements

\*\*\*\* END TYPE-8 data INPUT

\*\*\*\* BEGIN TYPE-8 data INPUT  
PART 3 CONTAINING 5608 ELEMENTS

\*\*\*\* END TYPE-8 data INPUT

\*\*\*\* BEGIN TYPE-8 data INPUT  
PART 4 CONTAINING 1065 ELEMENTS

\*\*\*\* END TYPE-8 data INPUT

\*\*\*\* BEGIN TYPE-8 data INPUT  
PART 5 CONTAINING 1029 ELEMENTS

```

**** END TYPE-8 data INPUT
**** Writing stress and strain output files ...

**** Hard disk file size information for postprocessor:
    ds.son   =      0.645 kilobytes
    ds.sof   =    11443.285 kilobytes
    ds.nso   =     5720.805 kilobytes
    ds.sto   =     5720.805 kilobytes

    Total MKNSO disk space used      =    22.34916 megabytes
**** End of successful execution
**** MKNSO elapsed time              =        0.098 minutes

**** The TOTAL elapsed time          =        0.394 minutes

```

## Meshing Log

### Part 1

Status: the part successfully meshed.

*Feature matching warning: 0 unmatched, 6 multi-matched features.*

---

#### Surface Mesh Statistics

| Mesh operation   | Solid mesh |
|------------------|------------|
| Final mesh size  | 4,73939 mm |
| Elements created | 878        |

---

**Solid Mesh Statistics**

|                     |                                                |
|---------------------|------------------------------------------------|
| Mesh type           | Mix of bricks, wedges, pyramids and tetrahedra |
| Watertight          | Yes                                            |
| Mesh has microholes | No                                             |
| Total nodes         | 1951                                           |
| Volume              | 4990,296823 mm <sup>3</sup>                    |
| Total elements      | 2844                                           |

|                            | <b>Tetrahedra</b> | <b>Pyramids</b> | <b>Wedges</b> | <b>Bricks</b> |
|----------------------------|-------------------|-----------------|---------------|---------------|
| Elements                   | 2068              | 599             | 108           | 69            |
| Volume %                   | -139,42           | 122,81          | 68,16         | 48,44         |
| Max. length ratio          | 62,2              | 19,3            | 3,2           | 3,3           |
| Avg. length ratio          | 4,6               | 4,4             | 2             | 2,2           |
| Avg. aspect ratio          | 1,3               | 1,4             | 1,1           | 1,1           |
| Unconstrained aspect ratio | 3                 | 2,3             | 1,2           | 1,1           |

---

## Log file

Length units used in the log file are modeling units: mm

-----

SOLID MESH GENERATION BEFORE ANALYSIS

-----

PROGRAM WILL USE THE FOLLOWING FILES:

Input: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

Output: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

COMMAND LINE:

C:\Program Files\Autodesk\Algor Simulation 2012\SOLIDX.exe -b=0 -o=1 -zw=2  
C:\Users\user\Documents\Inventor\Support Bracket\Assembly1 -ds=1 -d=0 -u=13 -c=2 -t=1 -progress\_pipe=4  
-cancel\_pipe=5 -za=-1 -zg=1:5 -n=1 -Td=1 -Tl=4.73939 -Tg=1,2 -Tq=100

TYPE OF OPERATION:

Meshing only surface defined by part 1  
Generating bricks, wedges, pyramids and tetrahedra elements  
Automatically minimizing aspect ratio of solid elements

FINAL STATISTICS:

Elements built (4,5,6,8 noded): 2844 ( 2068, 599, 100, 69 )  
Volume (4,5,6,8 noded X): 4990.296823 ( -139.42, 122.81, 68.16, 48.44 )  
Number of nodes: 1951  
Length ratios (avg) 4.6, 4.4, 2.8, 2.2  
Length ratios (max) 62.2, 19.3, 3.2, 3.3  
Aspect ratio: unconstrained ( 3.8, 2.3, 1.2, 1.1 )  
Average aspect ratios: ( 1.3, 1.4, 1.1, 1.1 )  
Number of restarts: 0  
Elapsed time: 0 minutes 18 seconds

Part 2 < Part1:1 >

Status: the part successfully meshed.

| Surface Mesh Statistics |  |            |
|-------------------------|--|------------|
| Mesh operation          |  | Solid mesh |

|                  |          |
|------------------|----------|
| Final mesh size  | 7,061 mm |
| Elements created | 2702     |

### Solid Mesh Statistics

|                     |                                                |
|---------------------|------------------------------------------------|
| Mesh type           | Mix of bricks, wedges, pyramids and tetrahedra |
| Watertight          | Yes                                            |
| Mesh has microholes | No                                             |
| Total nodes         | 5314                                           |
| Volume              | 494236,18618 mm <sup>3</sup>                   |
| Total elements      | 9794                                           |

|                            | Tetrahedra | Pyramids | Wedges | Bricks |
|----------------------------|------------|----------|--------|--------|
| Elements                   | 4470       | 3306     | 348    | 1670   |
| Volume %                   | 10,19      | 18,53    | 7,22   | 64,07  |
| Max. length ratio          | 144,4      | 19,8     | 8,3    | 3,7    |
| Avg. length ratio          | 6,4        | 4,1      | 2,3    | 1,6    |
| Avg. aspect ratio          | 1,4        | 1,3      | 1,1    | 1      |
| Unconstrained aspect ratio | 15         | 3,5      | 1,5    | 1,2    |

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## Log file

Length units used in the log file are modeling units: mm

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GENERATING SOLID MESH FOR ANOTHER PART

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PROGRAM WILL USE THE FOLLOWING FILES:

Inputs: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

Output: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

COMMAND LINE:

C:\Program Files\Autodesk\Algor Simulation 2012\SOL10X.exe -b=0 -o=1 -zw=2  
C:\Users\user\Documents\Inventor\Support Bracket\Assembly1 -ds=1 -d=0 -u=13 -c=2 -t=1 -progress\_pipe=4  
-cancel\_pipe=5 -za=1 -zg=1:5 -n=2 -Td=1 -Tl=7.061 -Tg=1,2 -Tq=100

TYPE OF OPERATION:

Meshing only surface defined by part 2  
Generating bricks, wedges, pyramids and tetrahedra elements  
Automatically minimizing aspect ratio of solid elements

FINAL STATISTICS:

Elements built (4,5,6,8 noded): 9794 ( 4470, 3306, 340, 1670 )  
Volume (4,5,6,8 noded %): 494236.106100 ( 10.19, 10.53, 7.22, 64.07 )  
Number of nodes: 5314  
Length ratios (avg) 6.4, 4.1, 2.3, 1.6  
Length ratios (max) 144.4, 19.8, 8.3, 3.7  
Aspect ratio: unconstrained ( 15.0, 3.5, 1.5, 1.2 )  
Average aspect ratios: ( 1.4, 1.3, 1.1, 1.0 )  
Number of restarts: 0  
Elapsed time: 0 minutes 27 seconds

**Part 3 < Part2:1 >**

Status: the part successfully meshed.

---

### Surface Mesh Statistics

|                  |            |
|------------------|------------|
| Mesh operation   | Solid mesh |
| Final mesh size  | 4,24651 mm |
| Elements created | 2183       |

### Solid Mesh Statistics

|                     |                                                |
|---------------------|------------------------------------------------|
| Mesh type           | Mix of bricks, wedges, pyramids and tetrahedra |
| Watertight          | Yes                                            |
| Mesh has microholes | No                                             |
| Total nodes         | 4274                                           |
| Volume              | 189118,038433 mm <sup>3</sup>                  |
| Total elements      | 5608                                           |

|                   | Tetrahedra | Pyramids | Wedges | Bricks |
|-------------------|------------|----------|--------|--------|
| Elements          | 2045       | 1426     | 276    | 1861   |
| Volume %          | 5,16       | 9,64     | 3,35   | 81,88  |
| Max. length ratio | 54,8       | 31,7     | 5,1    | 5,1    |
| Avg. length ratio | 4,8        | 3,7      | 2,5    | 1,6    |
| Avg. aspect ratio | 1,3        | 1,3      | 1,2    | 1      |

|                            |     |     |     |     |
|----------------------------|-----|-----|-----|-----|
| Unconstrained aspect ratio | 3,2 | 2,7 | 1,4 | 1,2 |
|----------------------------|-----|-----|-----|-----|

## Log file

Length units used in the log file are modeling units: mm

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GENERATING SOLID MESH FOR ANOTHER PART

-----

PROGRAM WILL USE THE FOLLOWING FILES:

Input: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

Output: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

COMMAND LINE:

C:\Program Files\Autodesk\Algor Simulation 2012\SOLUTION.exe -b=0 -o=1 -zw=2

C:\Users\user\Documents\Inventor\Support Bracket\Assembly1 -ds=1 -d=0 -u=13 -c=2 -t=1 -progress\_pipe=4  
-cancel\_pipe=5 -za=1 -zg=1:5 -n=3 -Td=1 -Tl=4,24661 -Tg=1,2 -Tq=100

#### TYPE OF OPERATION:

Meshing only surface defined by part 3

Generating bricks, wedges, pyramids and tetrahedra elements

Automatically minimizing aspect ratio of solid elements

#### FINAL STATISTICS:

Elements built (4,5,6,8 noded): 5608 ( 2045, 1426, 276, 1861 )

Volume (4,5,6,8 noded %): 109118.030433 ( 5.16, 9.64, 3.35, 81.85 )

Number of nodes: 4274

Length ratios (avg) 4.0, 3.7, 2.5, 1.6

Length ratios (max) 54.0, 31.7, 5.1, 5.1

Aspect ratio: unconstrained ( 3.2, 2.7, 1.4, 1.2 )

Average aspect ratios: ( 1.3, 1.3, 1.2, 1.0 )

Number of restarts: 0

Elapsed time: 0 minutes 10 seconds

**Part 4 < Part3:1 >**

Status: the part successfully meshed.

---

| Surface Mesh Statistics |            |
|-------------------------|------------|
| Mesh operation          | Solid mesh |
| Final mesh size         | 4,80737 mm |
| Elements created        | 1065       |

---

| Solid Mesh Statistics |                                                |
|-----------------------|------------------------------------------------|
| Mesh type             | Mix of bricks, wedges, pyramids and tetrahedra |
| Watertight            | Yes                                            |
| Mesh has microholes   | No                                             |
| Total nodes           | 1580                                           |
| Volume                | 97033,750281 mm <sup>3</sup>                   |
| Total elements        | 1065                                           |

|                   | Tetrahedra | Pyramids | Wedges | Bricks |
|-------------------|------------|----------|--------|--------|
| Elements          | 119        | 84       | 13     | 849    |
| Volume %          | 0,69       | 1,39     | 0,57   | 97,36  |
| Max. length ratio | 48,1       | 5,9      | 2,9    | 2,1    |

|                            |     |     |     |     |
|----------------------------|-----|-----|-----|-----|
| Avg. length ratio          | 5,3 | 2,9 | 2,2 | 1,1 |
| Avg. aspect ratio          | 1,3 | 1,3 | 1,1 | 1   |
| Unconstrained aspect ratio | 2,6 | 1,6 | 1,1 | 1,1 |

### Log file

Length units used in the log file are modeling units: mm

.....

GENERATING SOLID MESH FOR ANOTHER PART

.....

PROGRAM WILL USE THE FOLLOWING FILES:

Input: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

Output: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

# COMMAND LINE:

C:\Program Files\Autodesk\Algor Simulation 2012\SOLIDX.exe -b=0 -o=1 -zw=2  
C:\Users\user\Documents\Inventor\Support Bracket\Assembly1 -ds=1 -d=0 -u=13 -c=2 -t=1 -progress\_pipe=4  
-cancel\_pipe=5 -za=1 -zg=1:5 -n=4 -Td=1 -Tl=4.88737 -Tg=1.2 -Tq=100

## TYPE OF OPERATION:

Meshing only surface defined by part 4

Generating bricks, wedges, pyramids and tetrahedra elements

Automatically minimizing aspect ratio of solid elements

## FINAL STATISTICS:

Elements built (4,5,6,8 noded): 1065 ( 119, 84, 13, 849 )

Volume (4,5,6,8 noded X): 97033.750201 ( 0.69, 1.39, 0.57, 97.36 )

Number of nodes: 1500

Length ratios (avg) 5.3, 2.9, 2.2, 1.1

Length ratios (max) 48.1, 5.9, 2.9, 2.1

Aspect ratio: unconstrained ( 2.6, 1.6, 1.1, 1.1 )

Average aspect ratios: ( 1.3, 1.3, 1.1, 1.0 )

Number of restarts: 0

Elapsed time: 0 minutes 2 seconds

### Part 5 < Part3:2 >

Status: the part successfully meshed.

#### Surface Mesh Statistics

|                  |            |
|------------------|------------|
| Mesh operation   | Solid mesh |
| Final mesh size  | 4,80737 mm |
| Elements created | 1065       |

#### Solid Mesh Statistics

|                     |                                                |
|---------------------|------------------------------------------------|
| Mesh type           | Mix of bricks, wedges, pyramids and tetrahedra |
| Watertight          | Yes                                            |
| Mesh has microholes | No                                             |
| Total nodes         | 1569                                           |
| Volume              | 97000 mm <sup>3</sup>                          |
| Total elements      | 1029                                           |

|          | Tetrahedra | Pyramids | Wedges | Bricks |
|----------|------------|----------|--------|--------|
| Elements | 89         | 75       | 12     | 853    |

|                            |      |      |      |       |
|----------------------------|------|------|------|-------|
| Volume %                   | 0,52 | 1,33 | 0,47 | 97,69 |
| Max. length ratio          | 49   | 5    | 2,9  | 2,1   |
| Avg. length ratio          | 5,9  | 2,9  | 2    | 1,1   |
| Avg. aspect ratio          | 1,3  | 1,3  | 1,1  | 1     |
| Unconstrained aspect ratio | 2,6  | 1,9  | 1,1  | 1,1   |

Log file

Length units used in the log file are modeling units: mm

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GENERATING SOLID MESH FOR ANOTHER PART

-----

PROGRAM WILL USE THE FOLLOWING FILES:

Input: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

Output: C:\Users\user\Documents\Inventor\Support Bracket\Assembly1.FEM

#### COMMAND LINE:

C:\Program Files\Autodesk\Algor Simulation 2012\SOL10X.exe -b=0 -o=1 -zw=2  
C:\Users\user\Documents\Inventor\Support Bracket\Assembly1 -ds=1 -d=0 -u=13 -c=2 -t=1 -progress\_pipe=4  
-cancel\_pipe=5 -za=1 -zg=1:5 -m=5 -Td=1 -Tl=4.80797 -Tg=1.2 -Tq=100

#### TYPE OF OPERATION:

Meshing only surface defined by part 5

Generating bricks, wedges, pyramids and tetrahedra elements

Automatically minimizing aspect ratio of solid elements

#### FINAL STATISTICS:

Elements built (4,5,6,8 noded): 1029 ( 89, 75, 12, 853 )

Volume (4,5,6,8 noded X): 97000.000000 ( 0.52, 1.33, 0.47, 97.69 )

Number of nodes: 1569

Length ratios (avg) 5.9, 2.9, 2.0, 1.1

Length ratios (max) 49.0, 5.0, 2.9, 2.1

Aspect ratio: unconstrained ( 2.6, 1.9, 1.1, 1.1 )

Average aspect ratios: ( 1.3, 1.3, 1.1, 1.0 )

Number of restarts: 0

Elapsed time: 0 minutes 2 seconds