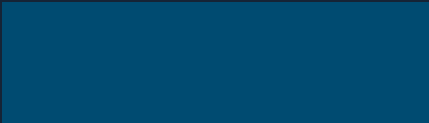




Internship Review (Public Use Version)

Linh Vu – Technical Intern Fall 2022

 – Manager (TF Team)

lvu4@u.rochester.edu

Commonwealth Fusion Systems



Overview

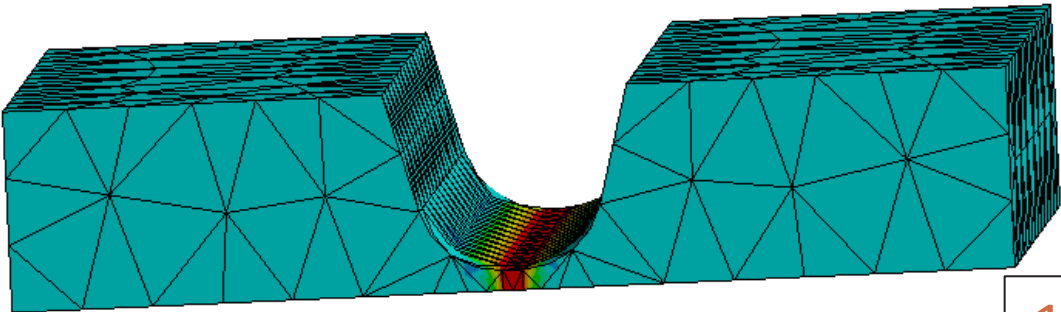
- A review of my remote, part-time internship in Fall 2022.
- Learning objectives
 - Skills learnt from using Ansys
 - Theoretical knowledge about material properties and behaviors
 - FEA
- Conclusion

3D Weld – 1st simplified model



C: Transient Thermal
Temperature 2
Type: Temperature
Unit: °C
Time: 5.e-002 s
12/16/2022 6:16 AM

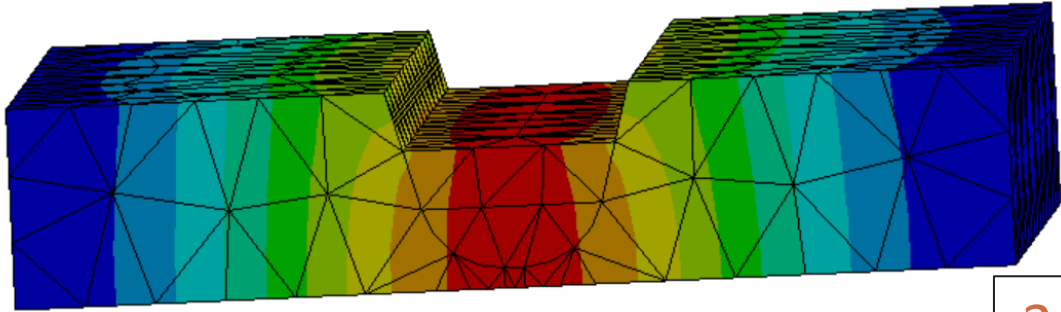
1600 Max
1372
1143.9
915.91
687.87
459.84
231.81
3.7789
-224.25
-452.28 Min



1

C: Transient Thermal
Temperature 205
Type: Temperature
Unit: °C
Time: 11101 s
12/16/2022 6:19 AM

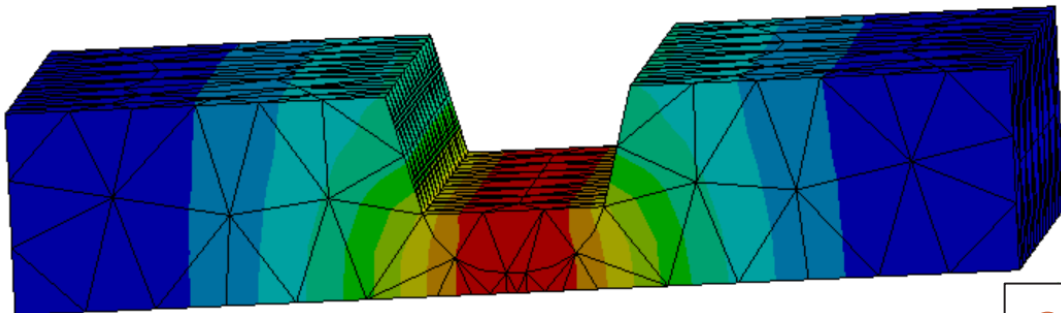
265.79 Max
260.94
256.08
251.22
246.36
241.5
236.64
231.78
226.92
222.06 Min



3

C: Transient Thermal
Temperature 76
Type: Temperature
Unit: °C
Time: 5051. s
12/16/2022 6:18 AM

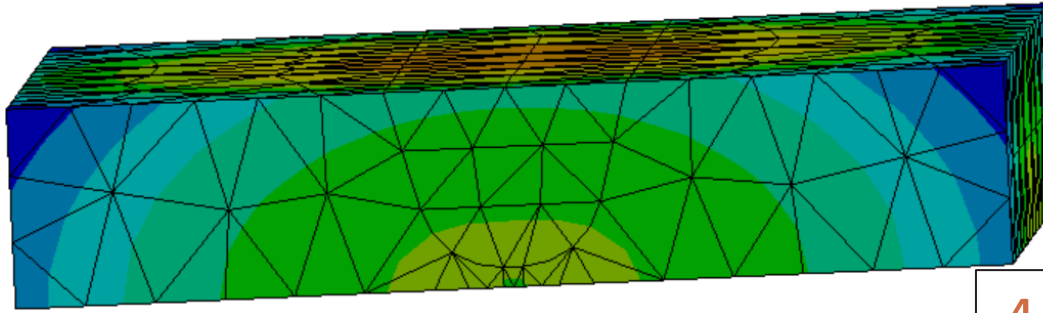
379.97 Max
354.03
328.09
302.14
276.2
250.26
224.31
198.37
172.43
146.48 Min



2

C: Transient Thermal
Temperature 497
Type: Temperature
Unit: °C
Time: 26000 s
12/16/2022 6:21 AM

23.341 Max
23.337
23.334
23.33
23.327
23.323
23.32
23.316
23.313
23.309 Min

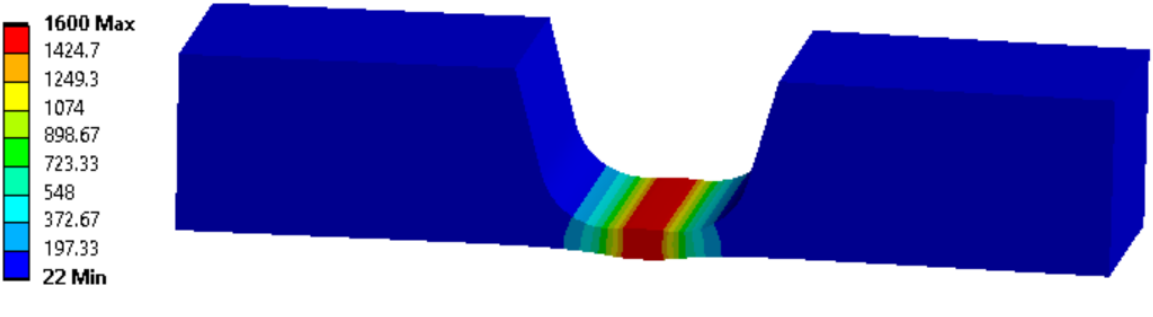


4

3D Weld – 2nd simplified model

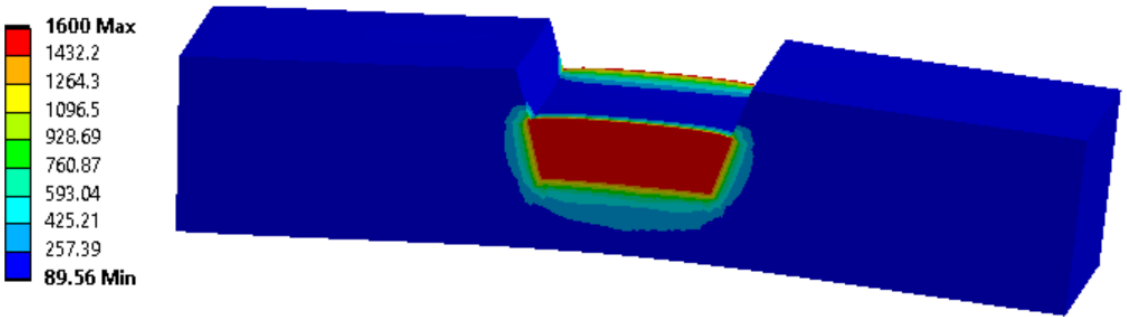


A: Coupled Field Transient
Temperature 2
Type: Temperature
Unit: °C
Time: 1 s
12/16/2022 6:38 AM



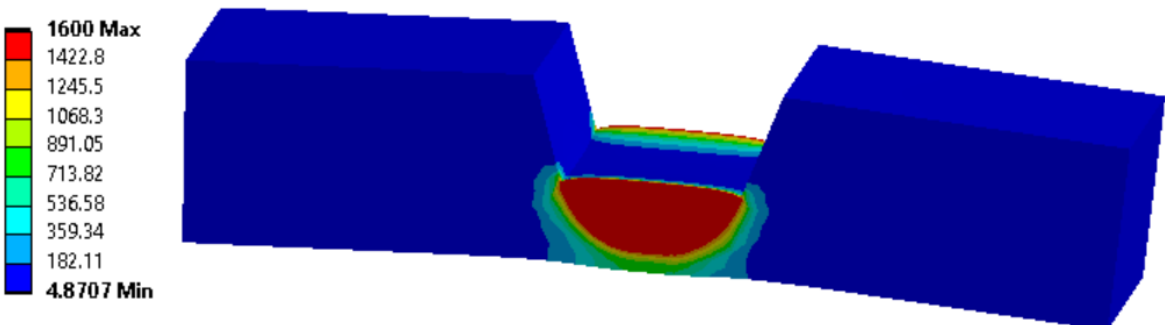
1

A: Coupled Field Transient
Temperature 53
Type: Temperature
Unit: °C
Time: 701 s
12/16/2022 6:40 AM



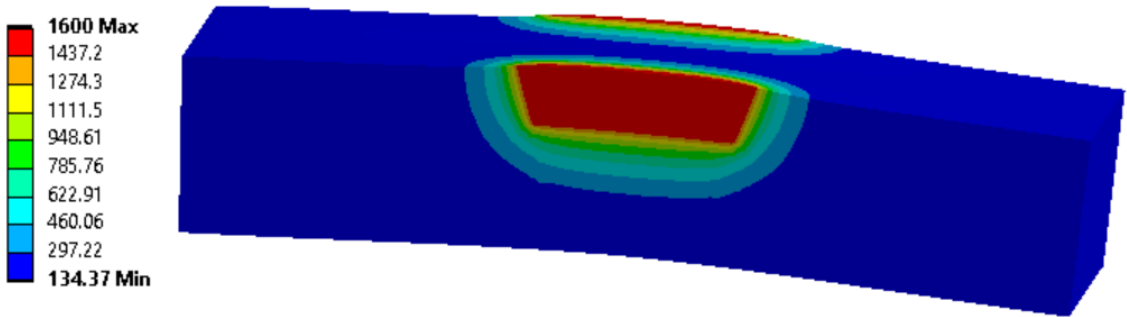
3

A: Coupled Field Transient
Temperature 24
Type: Temperature
Unit: °C
Time: 301 s
12/16/2022 6:39 AM



2

A: Coupled Field Transient
Temperature 86
Type: Temperature
Unit: °C
Time: 1152 s
12/16/2022 6:41 AM



4

Cube - Bilinear Isotropic Hardening (Uniaxial Compression on cube)



A: Static Structural

Directional Deformation Y 2

Type: Directional Deformation(Y Axis)

Unit: mm

Global Coordinate System

Time: 1.e-004 s

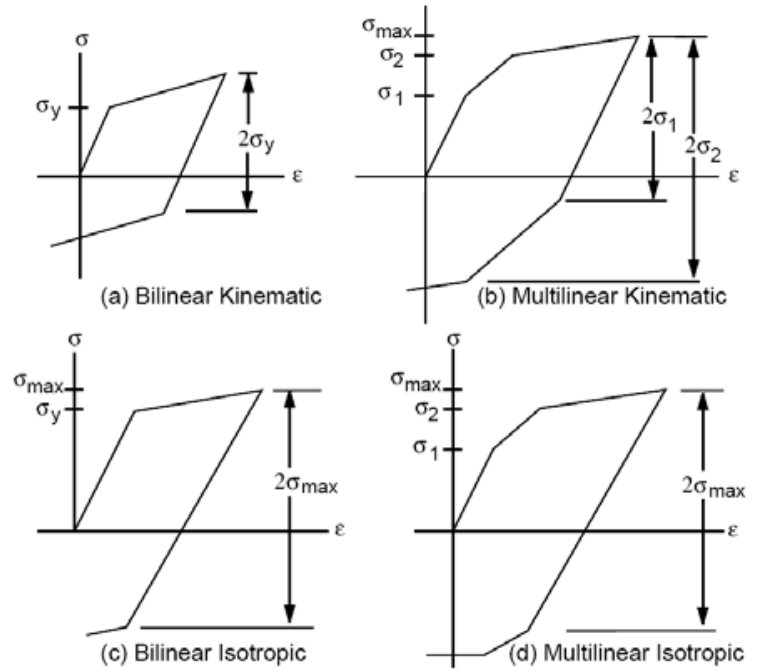
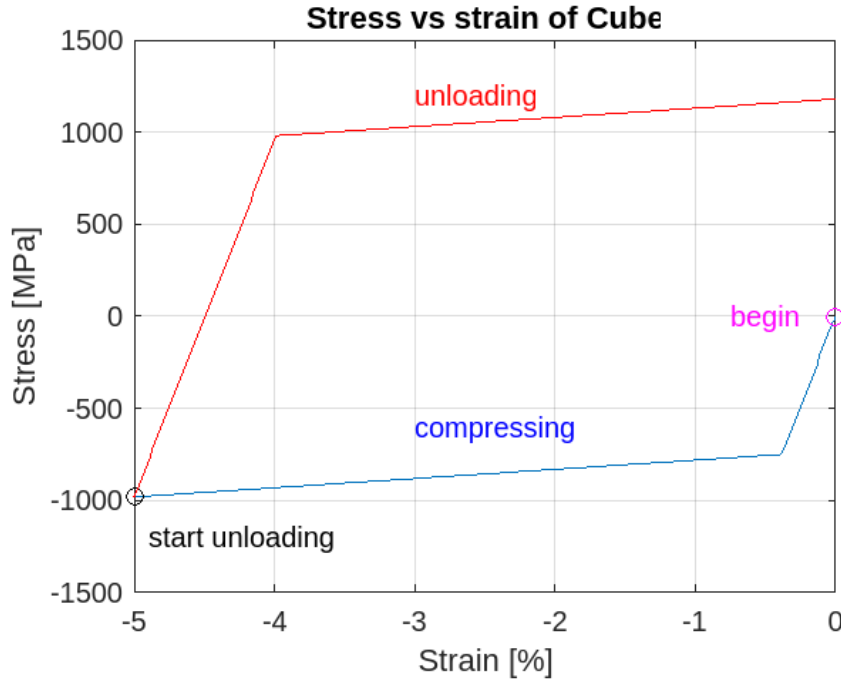
12/16/2022 6:49 AM



Step 1: From 0-2.5s: 0 to -0.5mm
(5% strain compressed)

Step 2: From 2.5-5s: -0.5mm to
0mm (5% strain unloaded)

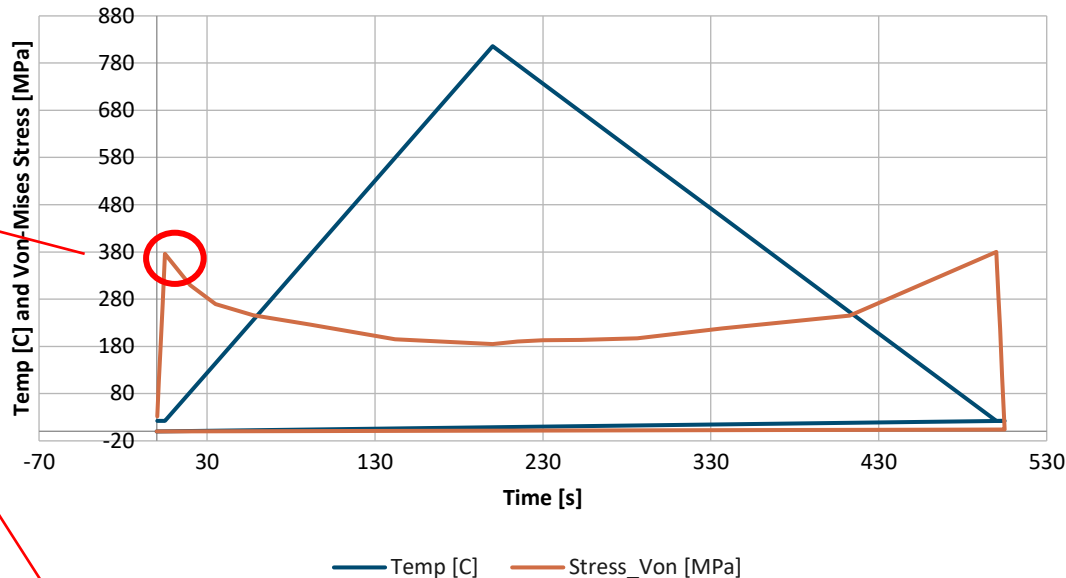
- 1.Young's modulus: 194 GPA
- 2.Poisson's ratio: 0.285
- 3.Yield strength: 750 MPa
- 4.Hardening modulus: 5 GPA



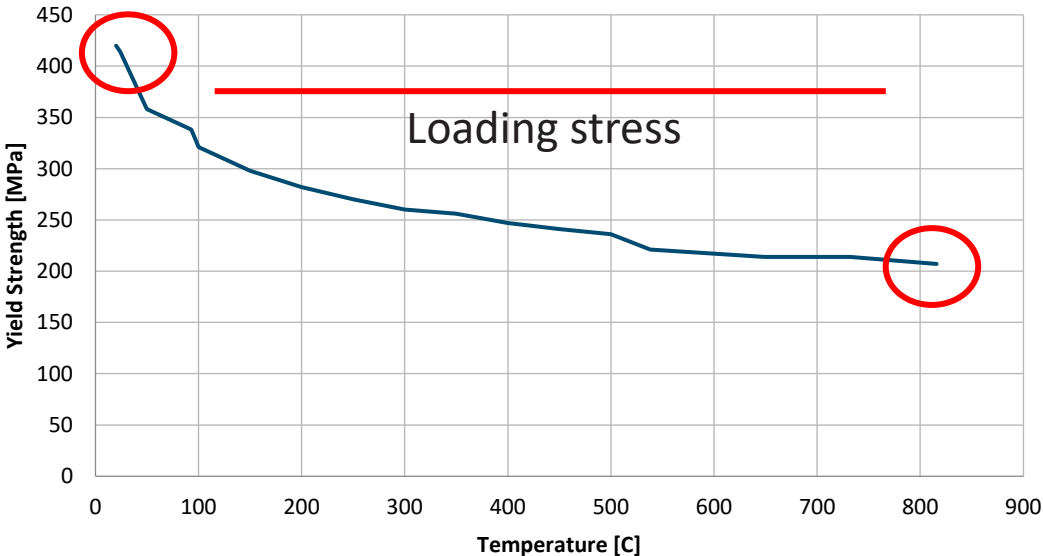
Cube – Perfect Plasticity with



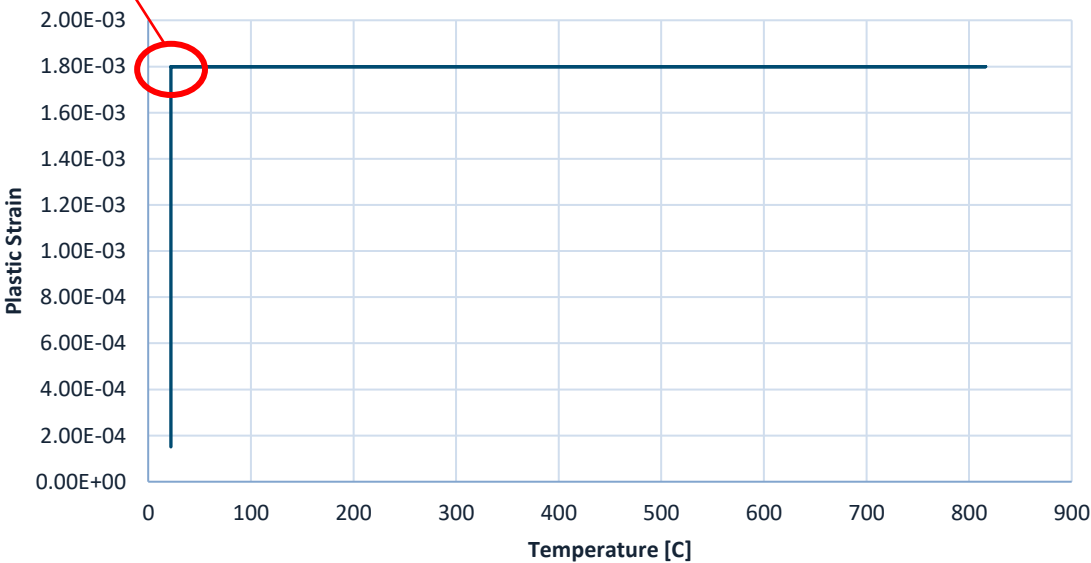
Temp, Stress vs Time



Yield Strength vs Temperature



Plastic Strain vs Temp



Loading point. SY(293) > Stress > SY(1000)

Cube – BPVC Hardening curve (Non-Plasticity) with



Temp [K]	Temp [C]	Yield Strength [MPa]	Ultimate Strength [MPa]	True UTS [MPa]	Step 0.85 Yield -> True UTS [MPa]
293	20	420	790	1122.48	38.27
297	24	414	739	1027.76	33.79

$R = \frac{\sigma_{YS}}{\sigma_{UTS}}$	$K = 1.5R^{1.5} - 0.5R^{2.5} - R^{3.5}$	$m_2 = 0.60 \cdot (1.00 - R)$	$\epsilon_p = 2.0 \cdot 10^{-5}$	$\epsilon_{YS} = 0.002$	$m_1 = \frac{\ln(R) + (\epsilon_p - \epsilon_{YS})}{\ln(\ln(1 + \epsilon_p)/\ln(1 + \epsilon_{YS}))}$	$A_1 = \frac{\sigma_{YS}(1 + \epsilon_{YS})}{\ln(1 + \epsilon_{YS})^{m_1}}$	$A_2 = \frac{\sigma_{UTS}e^{m_2}}{m_2^{m_2}}$
R	K: material parameter	m2	Ep	Eys	m1	A1	A2
0.532	0.369	0.351	0.00002	0.002	0.1376	990.12	1621.00
0.560	0.380	0.330	0.00002	0.002	0.1263	909.38	1481.75

Cube – BPVC Hardening curve (Non-Plasticity) with



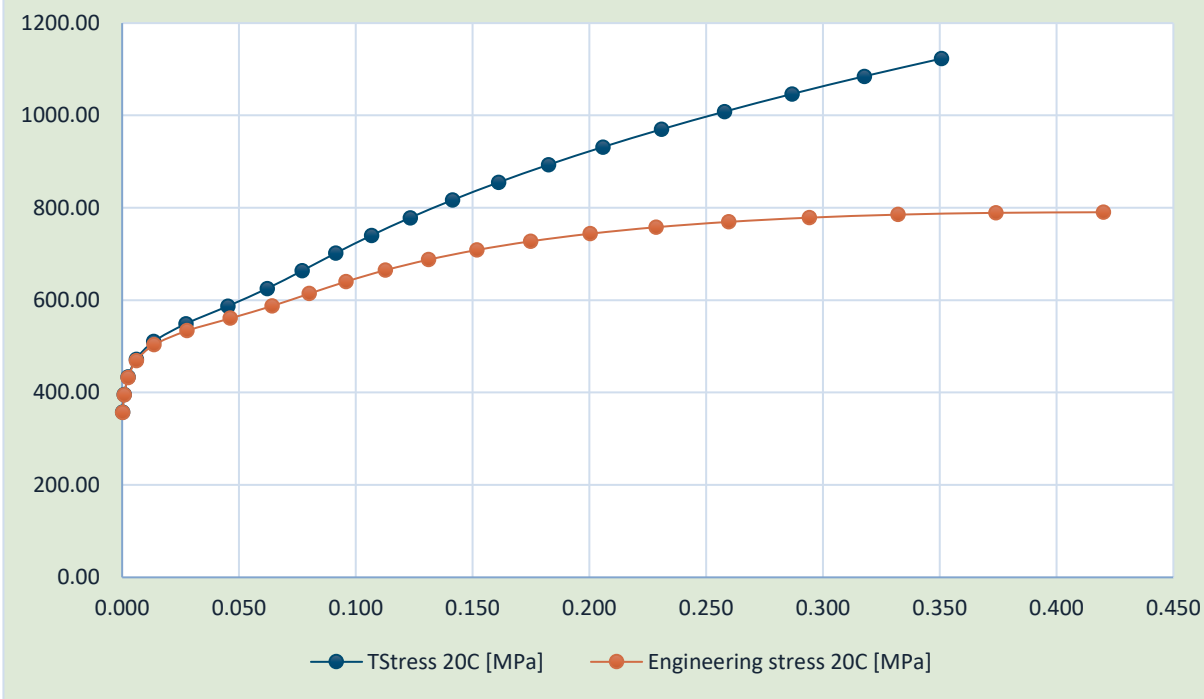
Temp [C]	Stress sigma_t [MPa]	H	E1	E2	gamma1	gamma2	Ep: plastic strain
20	357	-2.92	6.05E-04	1.35E-02	6.03E-04	3.88E-05	7.76E-05
20	395.27	-2.36	1.27E-03	1.80E-02	1.26E-03	1.58E-04	8.50E-04



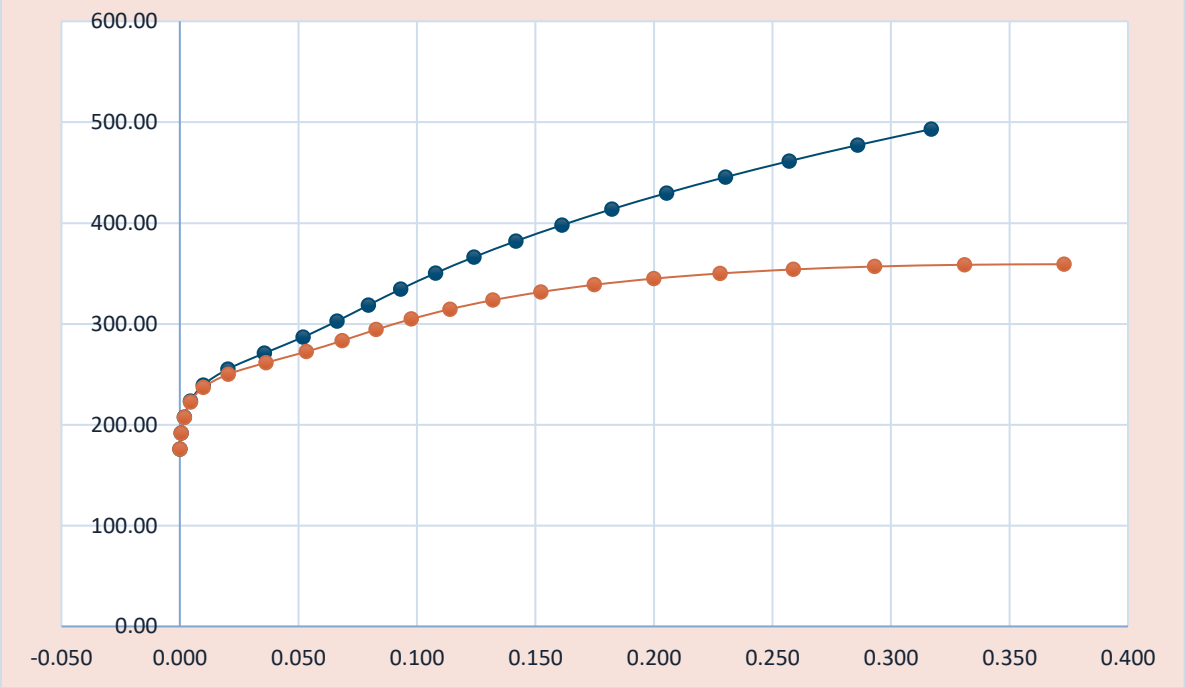
Cube – BPVC Hardening curve (Non-Plasticity) with



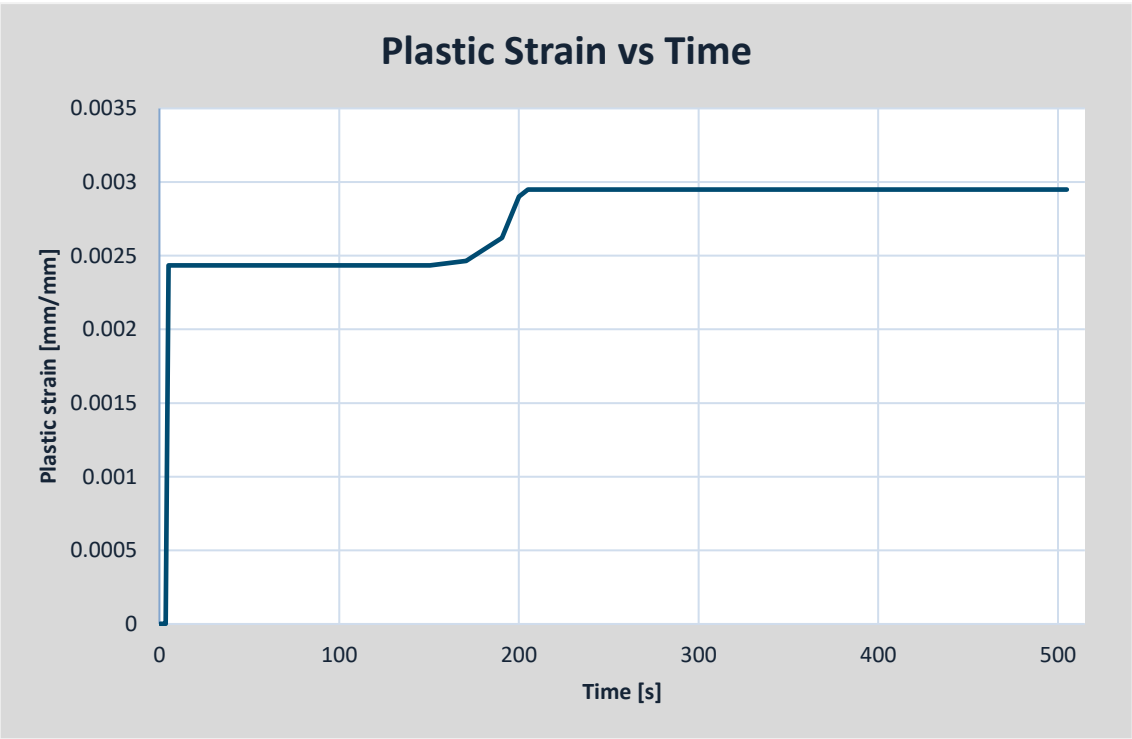
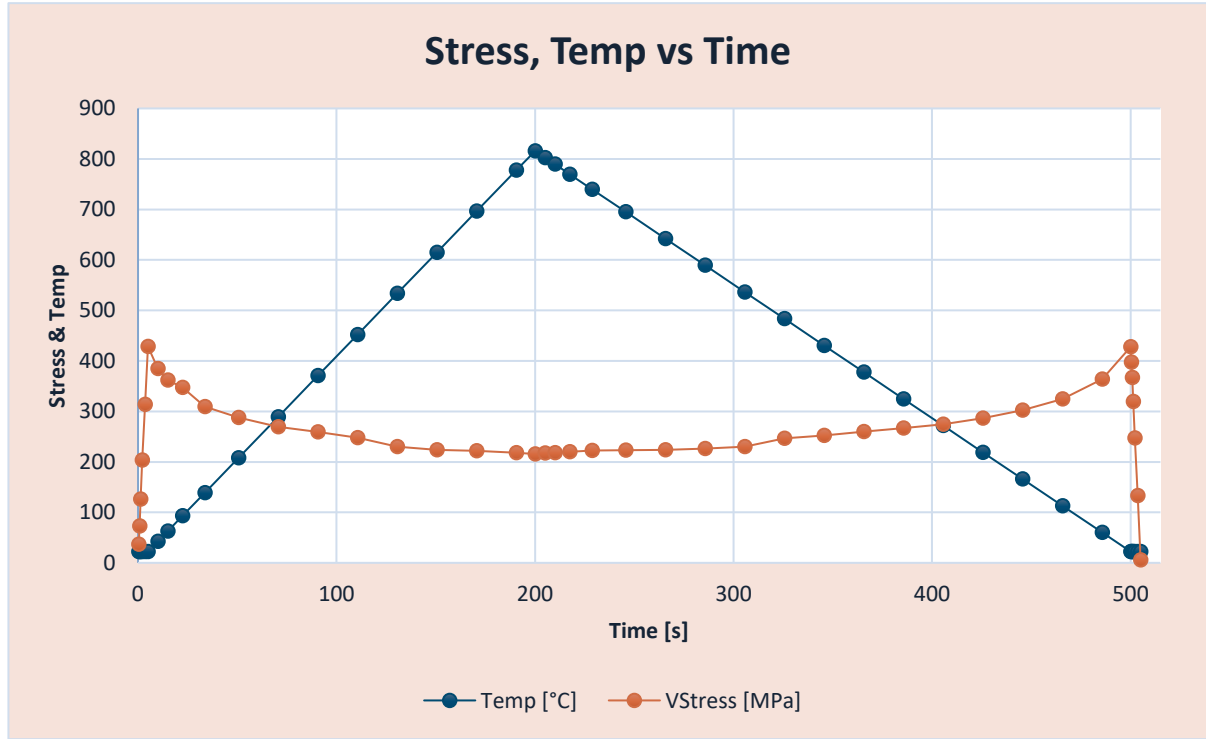
Plastic stress-strain at 20C



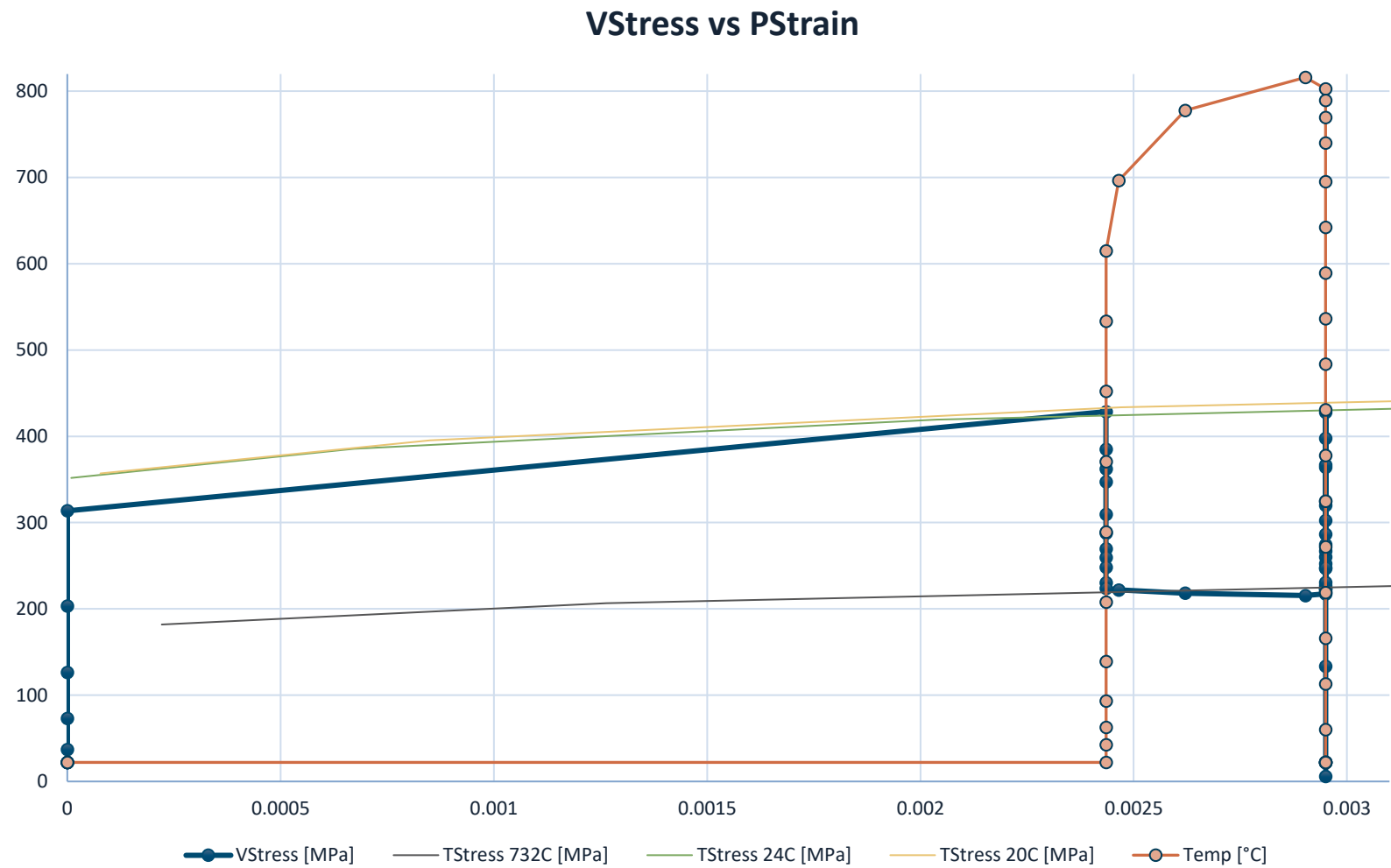
Plastic stress-strain at 816C



Cube – BPVC Hardening curve (Non-Plasticity) with



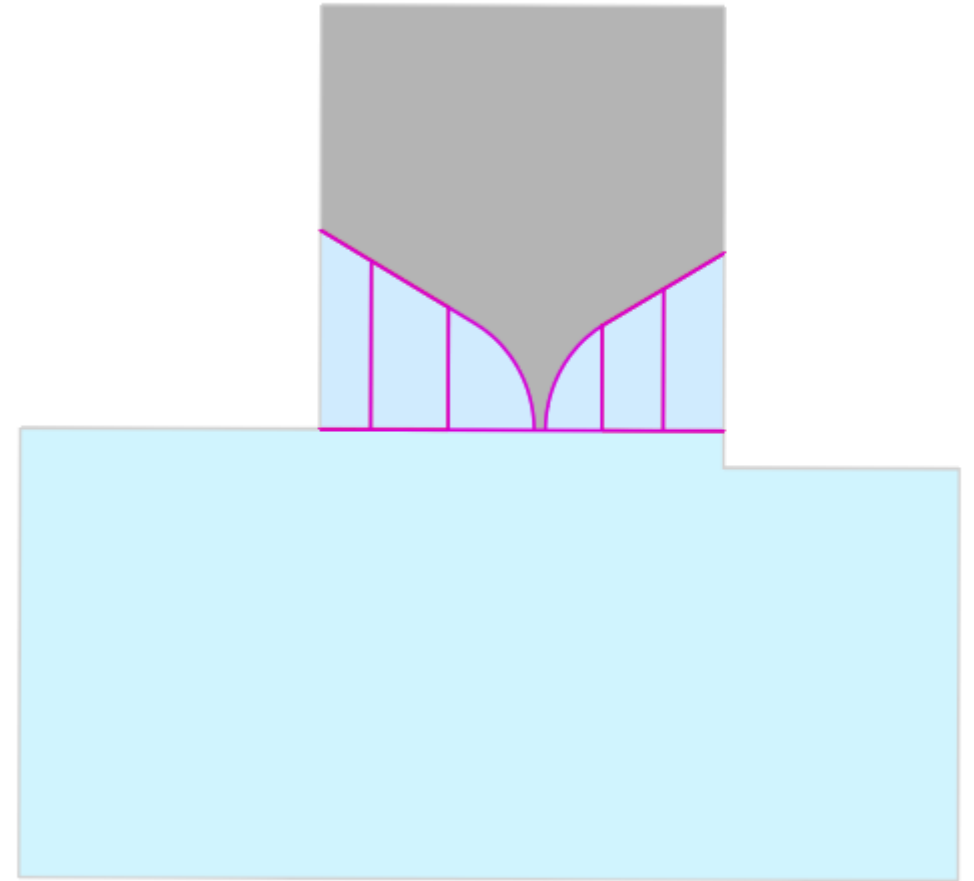
Cube – BPVC Hardening curve (Non-Plasticity) with



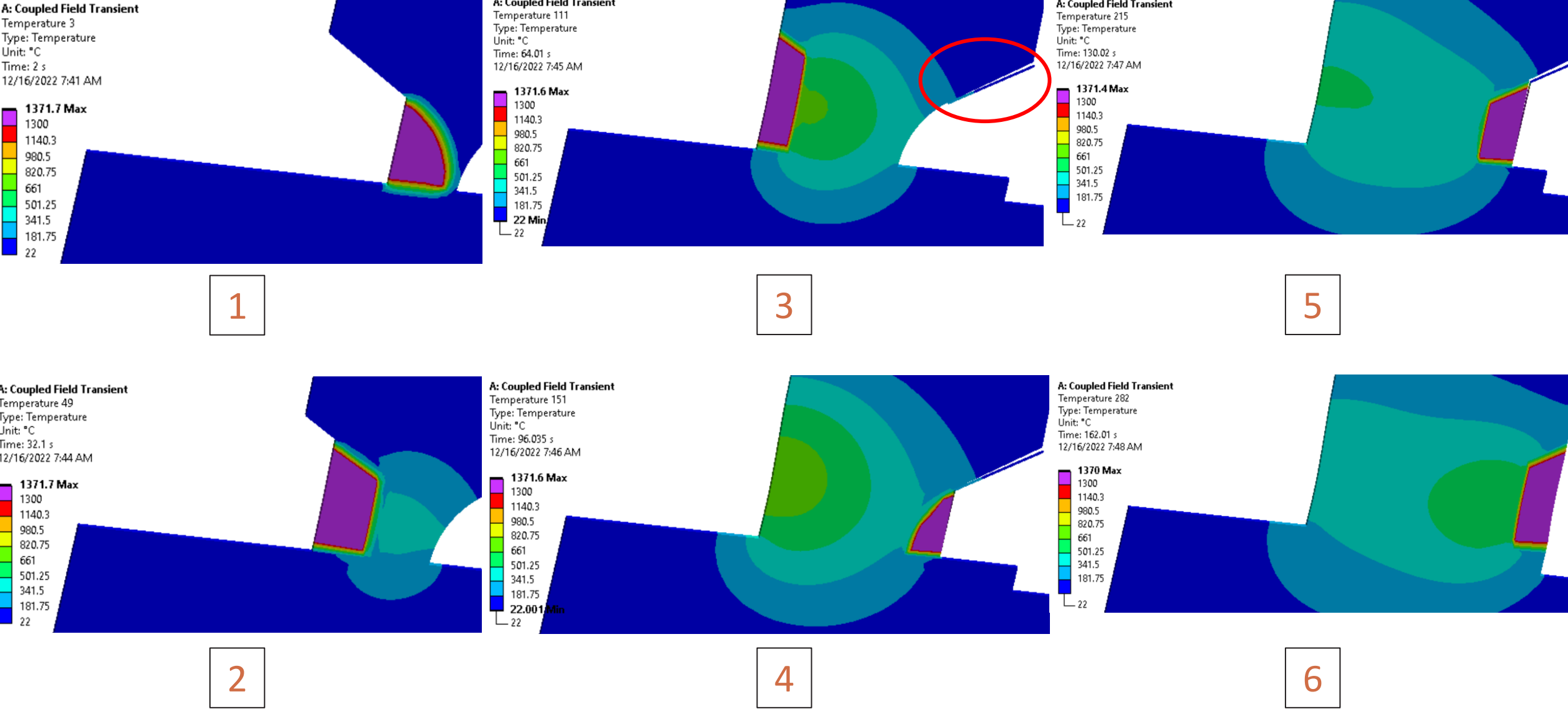
2D Weld – Mockup model



1mm thickness

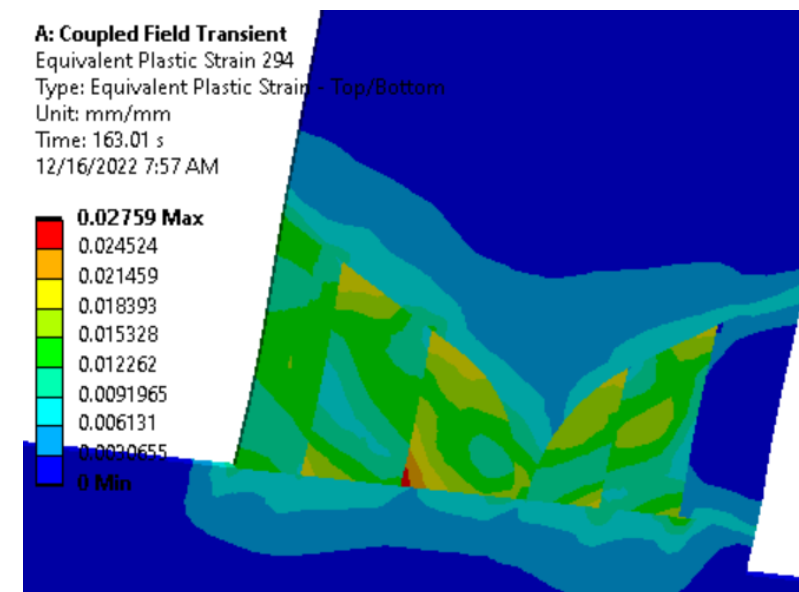
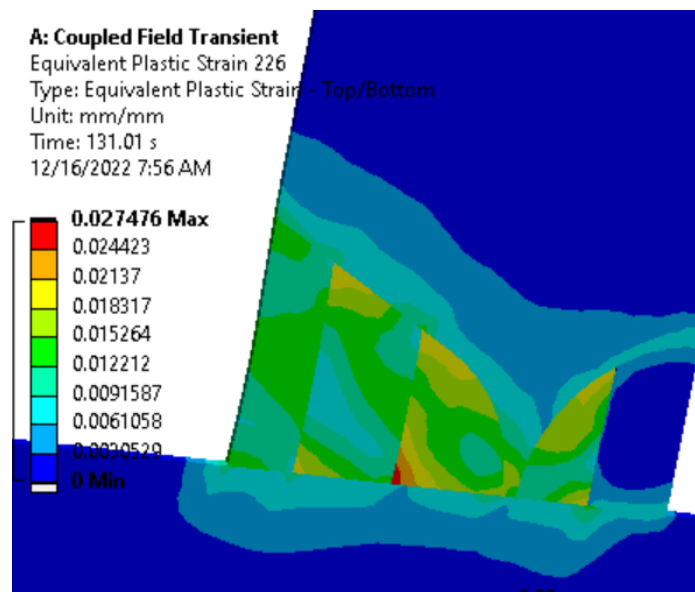
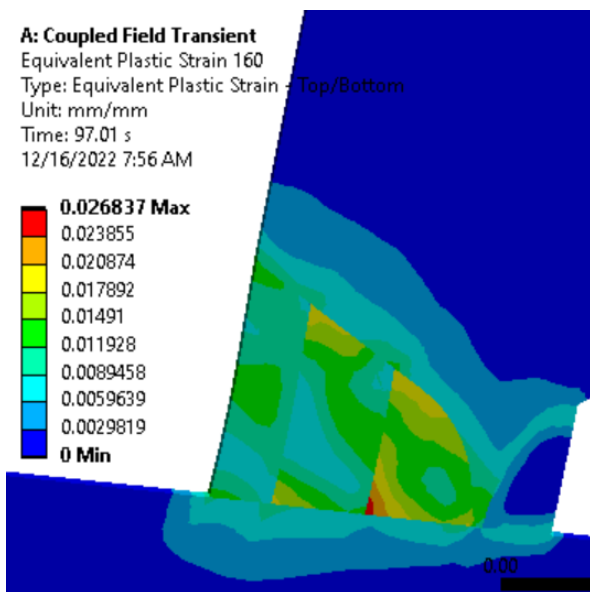
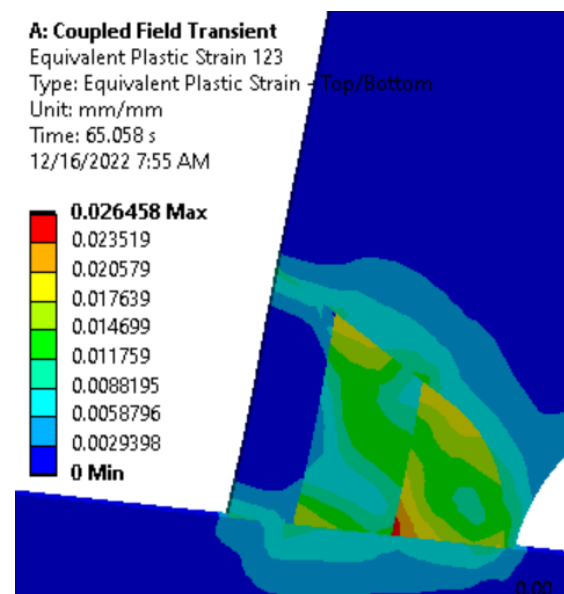
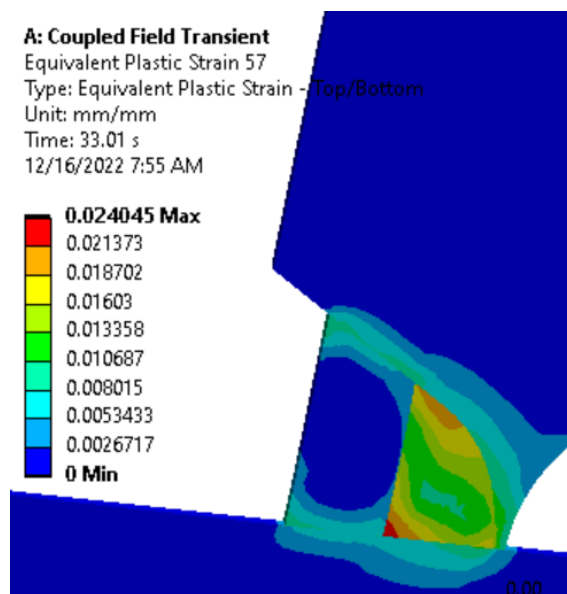
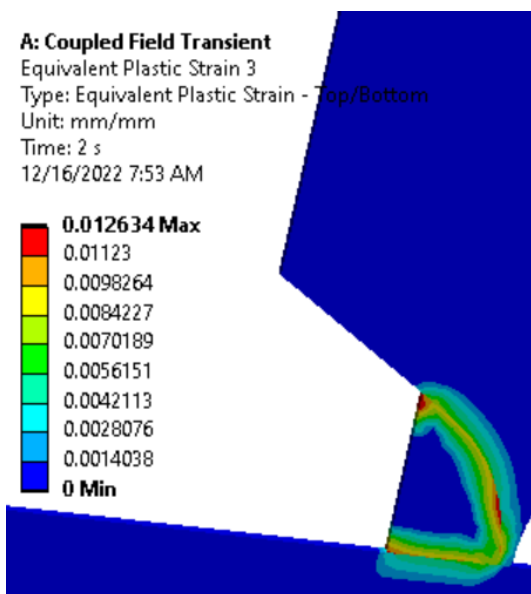


2D Weld – Mockup model

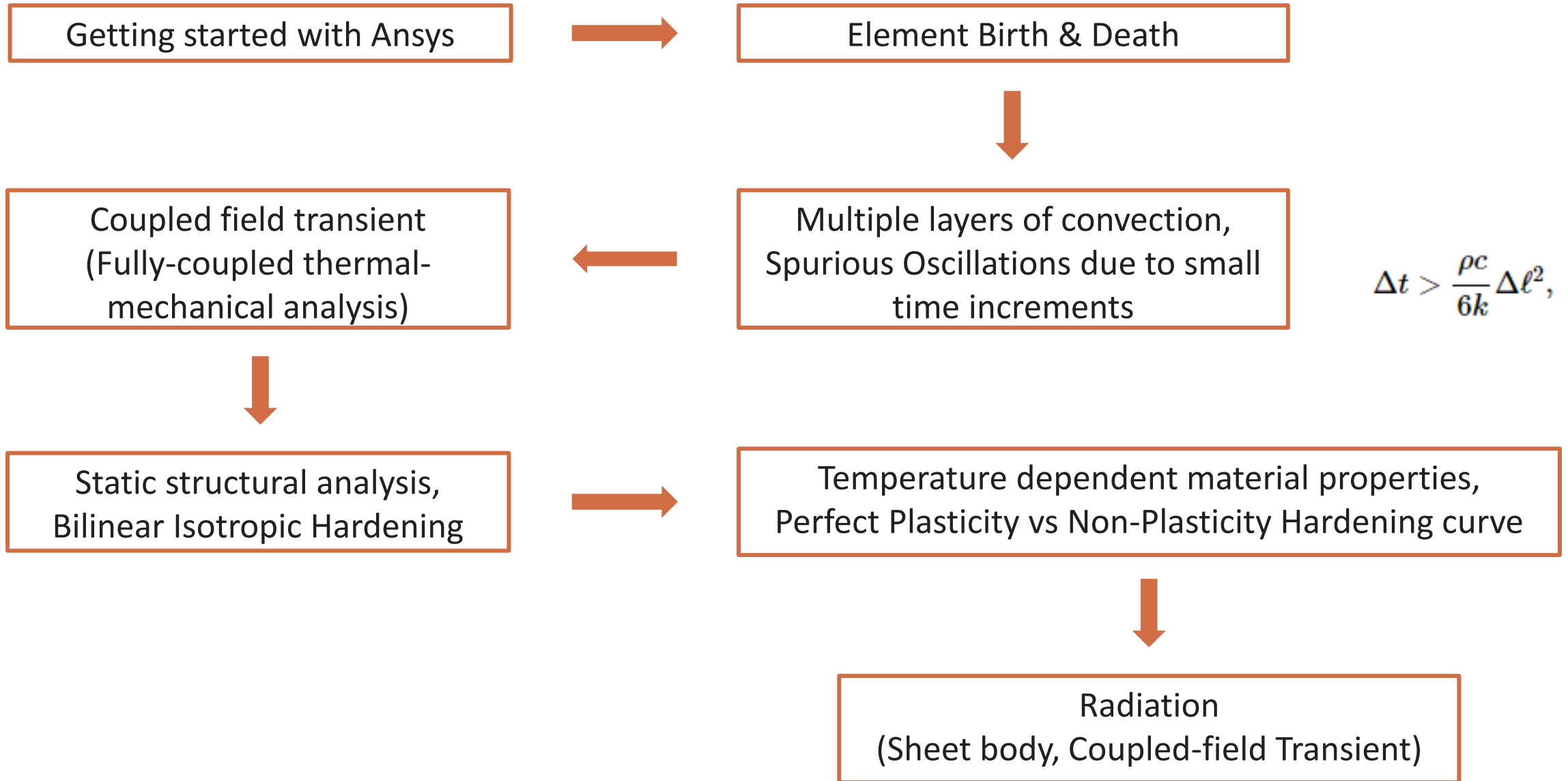


2D Weld –

Mockup model



2D Weld – Mockup model





Conclusion

- My personal thoughts
 - Learning opportunities
 - Time contribution
 - Interest
- My next steps
 - Developing interests
 - [REDACTED]
 - [REDACTED]
- Dedication
 - [REDACTED] – my manager
 - [REDACTED] – TF Team
 - [REDACTED] – my buddy

