MATLAB Project (#2) - Metallic Failure Analysis

SE-160A Aerospace Structural Analysis, University of California, San Diego (Copyright J.B. Kosmatka, 2020)

Version: **Winter, 2020 (v1)**

Project Title: **Reader Example, Volume 1, page 183 (3.57), 2-D Strain Rosette (0, 45, 90)**

Variable	Description	Value	Units
iInput	Input Units	1	1 = US, 2 = SI
iOutput	Output Units	1	1 = US, 2 = SI
ioption	Analysis Option	**2**	1 = Stress, 2 = Strain

Units Reference		
	US	*SI*
σ, τ	$10^3\ lb/in^2$	*MPa*
E, G	$10^6\ lb/in^2$	*GPa*

Material Properties

Variable	Description	A-Basis	B-Basis	Units
E	Young's Modulus	**10.3**	**10.3**	Msi
G	Shear Modulus	**3.9**	**3.9**	Msi
σ_{yT}	Yield strength - tension	**68**	**70**	Ksi
σ_{uT}	Ultimate strength - tension	**78**	**80**	Ksi
σ_{yC}	Yield strength - compressio	**-70**	**-73**	Ksi
σ_{uC}	Uultimate strength - compr	**-78**	**-80**	Ksi
τ_y	Yield strength - shear	**35.25**	**35.25**	Ksi
τ_u	Ultimate strength - shear	**46**	**48**	Ksi

Safety Factors

Variable	Description	Value	Units
SF_y	Safety Factor - yield	**1.1**	1
SF_u	Safety Factor - ultimate	**1.5**	1

[X] **Option 1: Applied Stress State**

Applied Stress State

Variable	Description	Value	Units
σ_{xx}	Stress (σ_{xx})		Ksi
σ_{yy}	Stress (σ_{yy})		Ksi
σ_{zz}	Stress (σ_{zz})		Ksi
τ_{yz}	Stress (τ_{yz})		Ksi
τ_{xz}	Stress (τ_{xz})		Ksi
τ_{xy}	Stress (τ_{xy})		Ksi

[X] **Option 2: Measured Strain State From Rosettes**

Strain Gage Rosette

Variable	Description	Value	Units
θ_A	Orientation Angle (A)	**0**	degree
θ_B	Orientation Angle (B)	**45**	degree
θ_C	Orientation Angle (C)	**90**	degree
θ	Gage Rotation Angle	**0**	degree

Measured Strains

Variable	Description	Value	Units
ε_A	Strain (A)	**1000**	μ in/in
ε_B	Strain (B)	**900**	μ in/in
ε_C	Strain (C)	**-400**	μ in/in

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MATLAB Project (#2) - Metallic Failure Measured Strain Analysis

SE-160A Aerospace Structural Analysis, University of California, San Diego (Copyright J.B. Kosmatka, 2020)

Version: Winter, 2020 (v2) - Input: US, Output: US/SI

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Student ID: A0123456789

Project Title: Reader Example, Volume 1, page 183 (3.57), 2-D Strain Rosette (0, 45, 90)

INPUT ECHO:

Variable	Description	Value	Units
iInput	Input Units	1	1 = US, 2 = SI
iOutput	Output Units	1	1 = US, 2 = SI
Ioption	Analysis Option	2	1 = Stress, 2 = Strain

Units Reference		
	US	*SI*
σ, τ	$10^3\ lb/in^2$	*MPa*
E, G	$10^6\ lb/in^2$	*GPa*

Material Properties

Variable	Description	A-Basis	B-Basis	Units
E	Young's Modulus	10.3000	10.3000	Msi
G	Shear Modulus	3.9000	3.9000	Msi
σ_{yT}	Yield strength - tension	68.0000	70.0000	Ksi
σ_{uT}	Ultimate strength - tension	78.0000	80.0000	Ksi
σ_{yC}	Yield strength - compressio	-70.0000	-73.0000	Ksi
σ_{uC}	Uultimate strength - compr	-78.0000	-80.0000	Ksi
τ_y	Yield strength - shear	35.2500	35.2500	Ksi
τ_u	Ultimate strength - shear	46.0000	48.0000	Ksi

Safety Factors

Variable	Description	Value	Units
SF_y	Safety Factor - yield	1.1	1
SF_u	Safety Factor - ultimate	1.5	1

Strain Gage Rosette

Variable	Description	Value	Units
θ_A	Orientation Angle (A)	0	degrees
θ_B	Orientation Angle (B)	45	degrees
θ_C	Orientation Angle (C)	90	degrees
θ	Gage Rotation from (x,y)	0	degrees

Measured Strains

Variable	Description	Value	Units
ε_A	Strain (A)	1000	μ in/in
ε_B	Strain (B)	900	μ in/in
ε_C	Strain (C)	-400	μ in/in

OUTPUT:

1.) Measured strains in structural frame (x,y)

Variable	Description	Value	Units
ε_{xx}	normal strain (x)	1000.000	μ in/in
ε_{yy}	normal strain (y)	-400.000	μ in/in
γ_{xy}	shear strain	1200.000	μ in/in

2.) Principal Strains

Variable	Description	Value	Units
ε_{11}	normal strain (1)	-621.954	μ in/in
ε_{22}	normal strain (2)	1221.954	μ in/in

3.) Allowable Strains

Variable	Description	A-Basis	B-Basis	Units
ε_T*	Allowable Tension	**5048.544**	**5177.994**	μ in/in
ε_C*	Allowable Compression	**-5048.544**	**-5177.994**	μ in/in
γ_R*	Allowable Shear	**7863.248**	**8205.128**	μ in/in
γ_T*	Allow Shear Tresca Mixed	**2524.272**	**2588.997**	μ in/in

4.) Margin of Safety (Saint Venant Failure Criteria)

Variable	Description	A-Basis	B-Basis	Units
MS	Margin of Safety	**3.1315**	**3.2375**	1

End of Output