Laminate_Analysis Introduction & Handbook

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Contents

1 Composite Material Calculation with CLT

1.1 class Fibre

The class designed to define and change the fibre material's properties.

1.1.1 eg.

```
f = Fibre(Ef1=74000,Ef2=74000,Gf12=30800,\
        vf21=0.2,density=2.55)
```

1.2 class Matrix

The class designed to define and change the matrix material's properties.

1.2.1 eg.

```
m = Matrix(Em=300,Gm=1222,vm=0.35,density=1.18)
```

1.3 class Lamina

The class is used to define the signal lamina, its properties and engineering constants.

In the lamina initialization, you need to give the Elastic moduli E_1, E_2, the shear moduli G_{12}, the major Poisson's ration v_{21} or v_{12}. And if you want to do the strength failure analysis, you need to give the tensile strength and compressive strength parallel to the fibre X_t, X_c, the tensile strength and compressive strength of the unidirectional layer transverse to the fibre Y_t, Y_c, and the shear strength S_{21}. Don't forget to define the angle and thickness of the lamina.(All the constants' default value are zero 0)

And the second way to define from the fibre and matrix materials have been defined above, read the example to get more.

1.3.1 eg. define lamina directly

```
a=Lamina(E1=5.4e4,E2=0.001,G12=0.001,v21=0.25,
Xt=1.05e3,Xc=1.05e3,Yt=28,Yc=140,S=42,
angle=0,thickness=1)
```

1.3.2 eg. define lamina by fibre and matrix

```
a = Lamina(fibre=f , angle = 0 ,thickness=1 )
b = Lamina(matrix=m, angle = 90,thickness=10.0)
```

After define the lamina,you can get the matrix of the lamina,like matrix_Q or matrix_Qbar, you can get more if you look for the source code.

1.4 class Laminate

The class is used to define the Laminate.

After the laminate initialization, you need to add the lamina as the lay up order of the laminate order.Then update the laminate you define,you can get the matrix_ABD, the thickness and so on.

1.4.1 eg.

```
LA = Laminate()   #laminate initialization
LA.add_Lamina(a) #add lamina
LA.add_Lamina(a)
LA.update()       #update and start calculation
LA.repalce_Lamina(0,b)
#replace the first(start form 0) lamina_a with the lamina_b
LA.remove_Lamina(0) #remove the first lamina
LA.update() #need to update again when change the lamina
```

1.5 class Loading

The class is used to define the Loading apply to the laminate.

After the laminate update, you can apply the load defined to the laminate, and get the stress and strain σ_1, σ_2,τ_{12} in the lamina COS, the stress and strain σ_x, σ_y,τ_{xy} in the laminate COS.

1.5.1 eg.

```
Load = Loading(1,0,0,0,0,0) #load define
Load.apple_to(LA) # load apply to laminate
Load.change_Load(2,0,0,0,0,0) #change load
Load.apple_to(LA) # load apply to laminate again
```

1.6 class Failure_Criterion

The class is used text the strength of the laminate use Failure_Criterion.You can choose which lamina to test or whole laminate.

1.6.1 eg.

```
c=Failture_Criterion()  #Criterion initialization
c.Tsai_Hill(Load,layer_num=1)
#choose the strength criterion and which lamina or all
r= c.ret_list #get the answers
```

1.7 laminate_Tools Introduction

This part can print, save and plot the results in excel file format, you should give a name of the results you want to save.(the default do not save,and the name without '.' in). When calling the function, you can also choose which lamina's results to show or show all the laminate.

1.7.1 eg.

```
print Report_strain(Load,mode='12')
plot_strain(Load,mode='xy',max_ten=None,mode2='1')
```