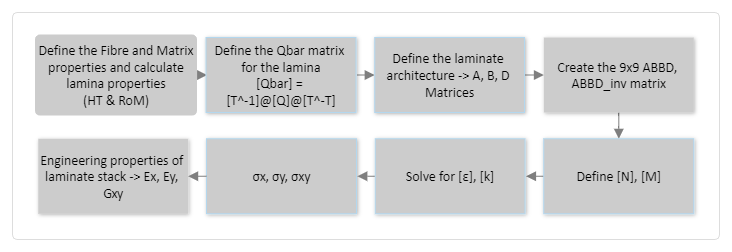
***SESG6039 – Composites Engineering Design and Mechanics - Individual Assignment 1  
CLPT CALCULATOR***

***Name:*** *Abhinandan Thour* ***Student ID:*** *32453515*

***Question 1)***The code matches the results of the worked example as shown:



**STEP 1 - Define the Fibre and Matrix properties and calculate lamina properties (HT & RoM)**

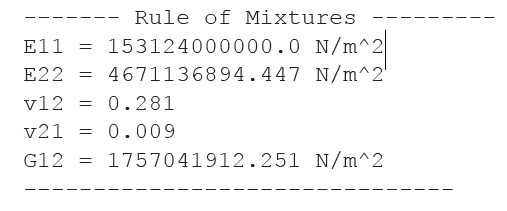
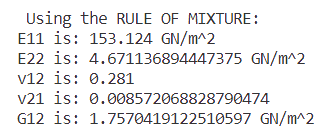
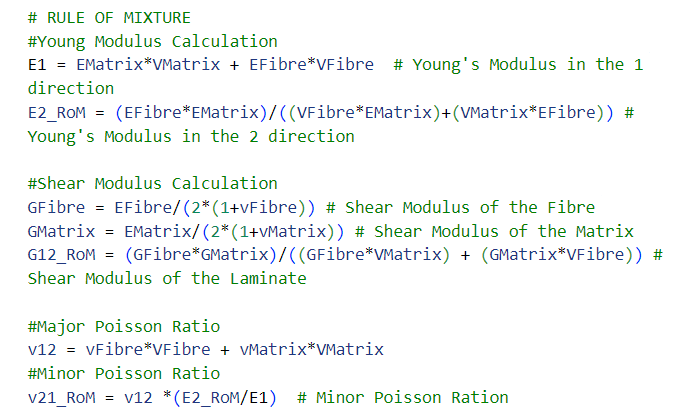
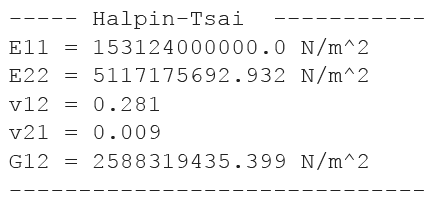
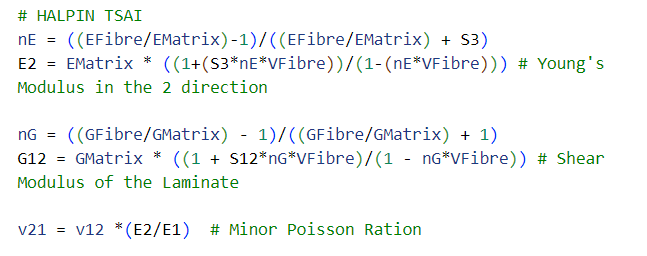
***Rule of Mixture:***  


Figure 3 - Results calculated (RoM)

Figure 1 - Results in the Worked example (RoM)

Figure 3 - Code to calculate Properties (RoM)

***Halpin-Tsai:***

******

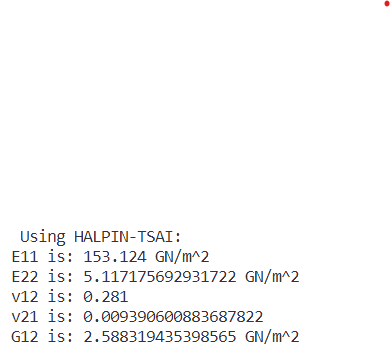
***STEP 2 - Define the Qbar matrix for the lamina -> [Qbar] = [T^-1]@[Q]@[T^-T]***

Figure 5 - Code to calculate Properties (HT)

Figure 4 - Results calculated (HT)

Figure 2- Results on the Worked example (HT)

* ***Calculating Q matrix***

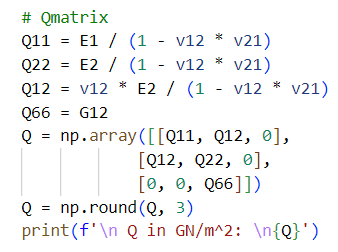
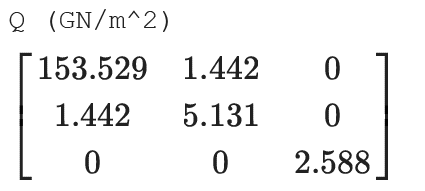
**

Figure 3 - Results of Q from worked Example.

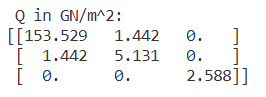
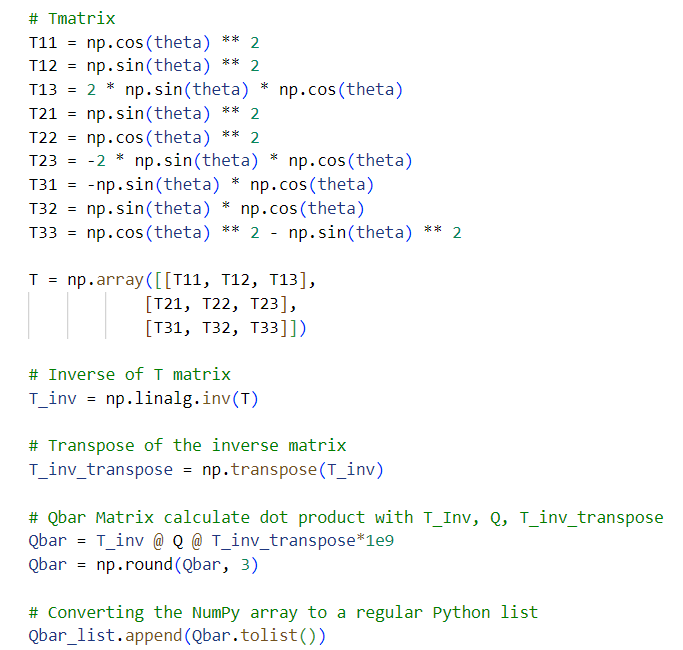
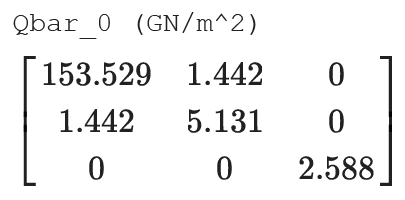
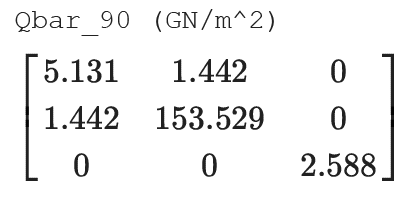
**

Figure 4 - Code to calculate the Q matrix.

Figure 5 - Results of Q calculated.

* ***Calculating Qbar***





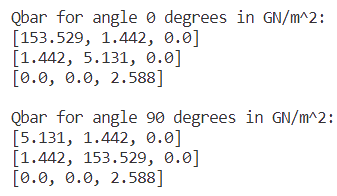
 Figure 7 - QBar from worked example.

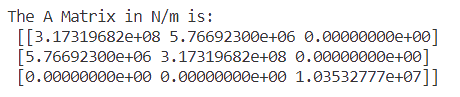
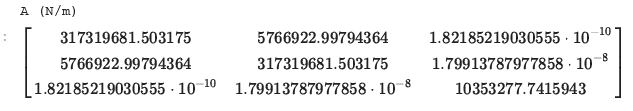
Figure 6 - QBar calculated.

Figure 4 - Code to calculate the Qbar matrix.

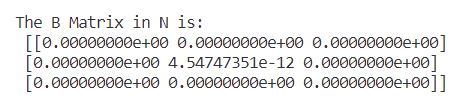
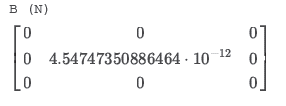
To calculate different Qbar matrixes a for loop has been used to iterate through different angle orientation and then append/store this new value in a new list defined before the start of the loop. This has been done for the [A], [B] and [D] matrix as well.

**STEP 3 - Define the laminate architecture -> A, B, D Matrices**

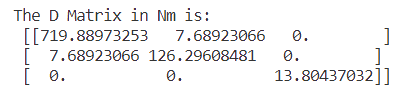
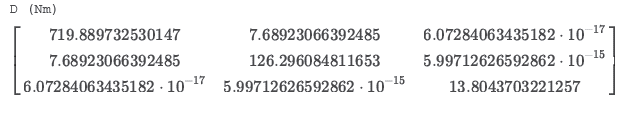
* *A Matrix Comparison*

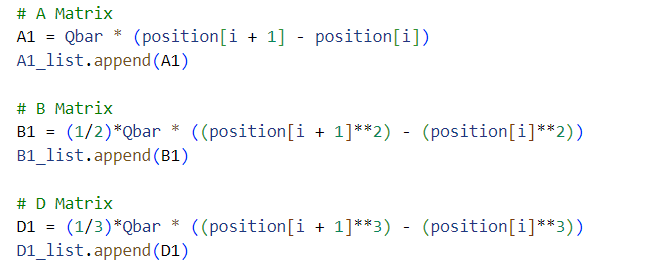


*B Matrix Comparison*

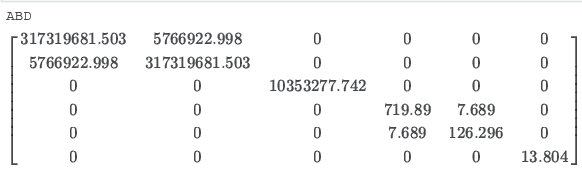
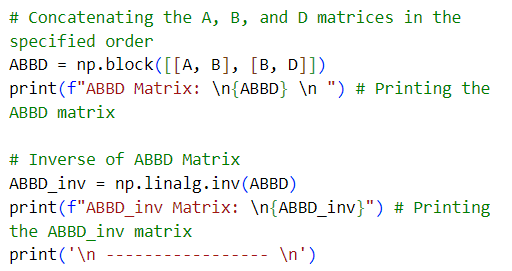


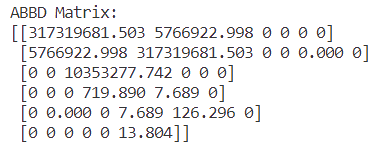
*D Matrix Comparison*

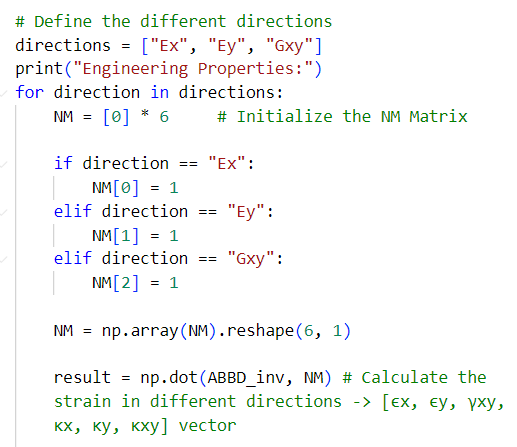


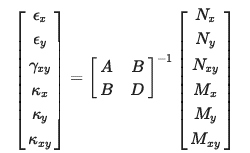


**Step 4 - Create the 9x9 ABBD, ABBD\_inv matrix**

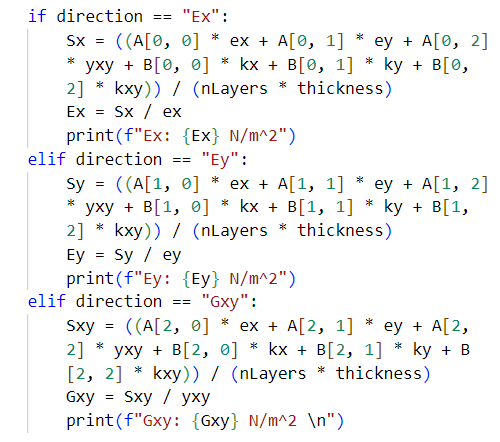




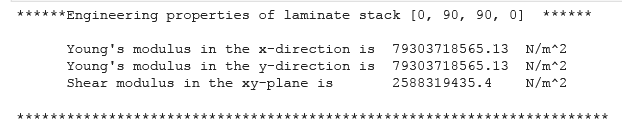
**Step 5, 6 - Define [N], [M] and Solve for [ε], [k]**

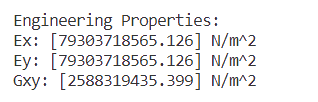
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**Step 7, 8 - σx, σy, σxy and Engineering properties of laminate stack -> Ex, Ey, Gxy**

****

****

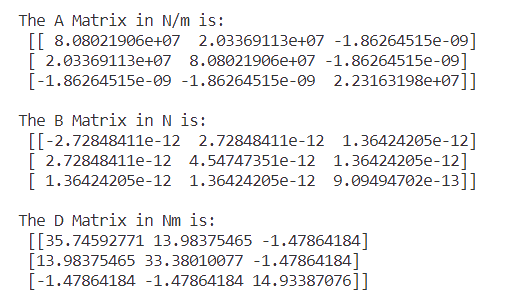
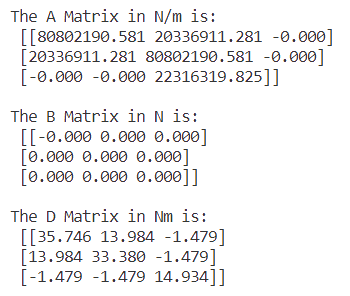




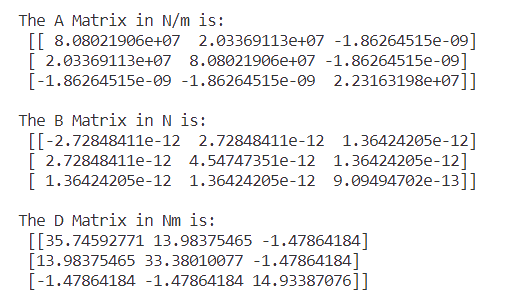
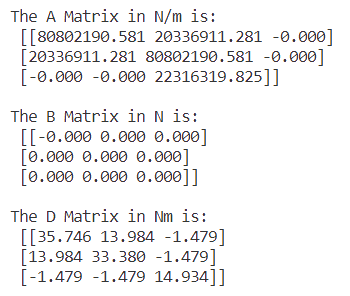
***Question 2)***

|  |  |
| --- | --- |
| **Laminate configuration** | *[-45, +45, 0, 90, 90, 0, 0, 90, 90, 0, +45, -45]* |
| **Thickness**: | *0.2mm* |
| ***Young’s Modulus in 1 direction*** | *E1 = 54 GPa* |
| ***Young’s Modulus in 1 direction*** | *E2 = 18 GPa* |
| ***Poisson Ratio of the laminate*** | ***v12 =*** *0.28* |
| ***Shear Modulus of the laminate*** | ***G12 =*** *6 GPa* |

A Matrix:

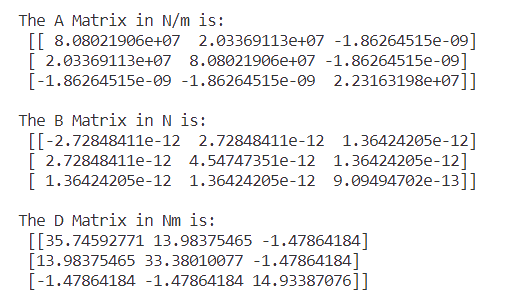
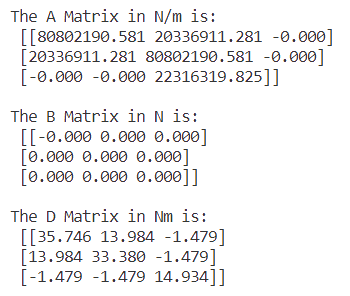


D Matrix:



***Question 3)***

B Matrix:

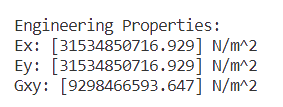


The reason why the B matrix should be zero is due to symmetrical structure, the B matrix shows the value for …., as these forces are opposite to each other they cancel out, therefore the value of B is 0.

The reason why we do not get exactly zero for [B] can be due to computational error or due to the forces on the laminate are almost equal to zero to many decimal place, as they try cancel out, the different is so minimal that we do not have exactly zero.

***Explain why the [B] matrix for this laminate should be zero? When we do the calculations we do not get exactly zero for every term in the [B], why does this occur?***

***Question 4)***

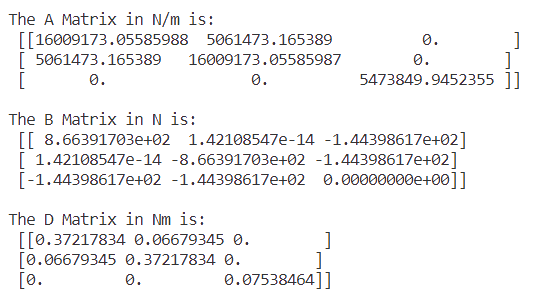
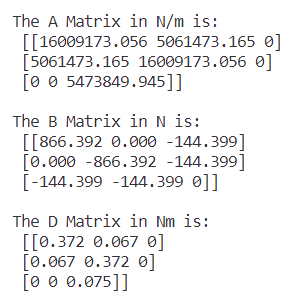
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***Comment on the values obtained, with respect to the laminate***

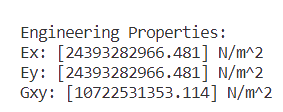
***Question 5)***

|  |  |
| --- | --- |
| **Laminate configuration** | [90, 45,-45, 0] |
| **Thickness**: | *0.125mm* |

The resulting matrices are:



The Young’s Modulus on the X and Y direction are:



***Discuss the results obtained with respect to the laminate stacking sequence and the ABD matrix.***