Thanks to the power of solidworks we are able to not only, run finite element analyis, but also export the generated data into a format readable in notebookes (csv)

In this notebook we derive some visualisation from FEA tests:

- A torsion test is done on the extension sub assembly
  - Stress and strain data extracted
- A force test is done on the bottom screw hook sub assembly
  - Stress and strain data extracted

most of the code is extracted from notebooks in the python folder so detail is not so intense (comments)

In [15]:
```
# Import the relevant modules and libraries
import numpy as np
import pandas as pd
import matplotlib
import matplotlib.pyplot as pp
from scipy.stats import anderson
import prettytable
from prettytable import PrettyTable
import seaborn as sns

# Now the dataframe needs to be imported and defined
df = pd.read_csv('Assem1-Static 1-Results-Stress1-1_Copy.csv')
df.head() # print the first few rows of the table to verify proper importing
# we can see the output below
```

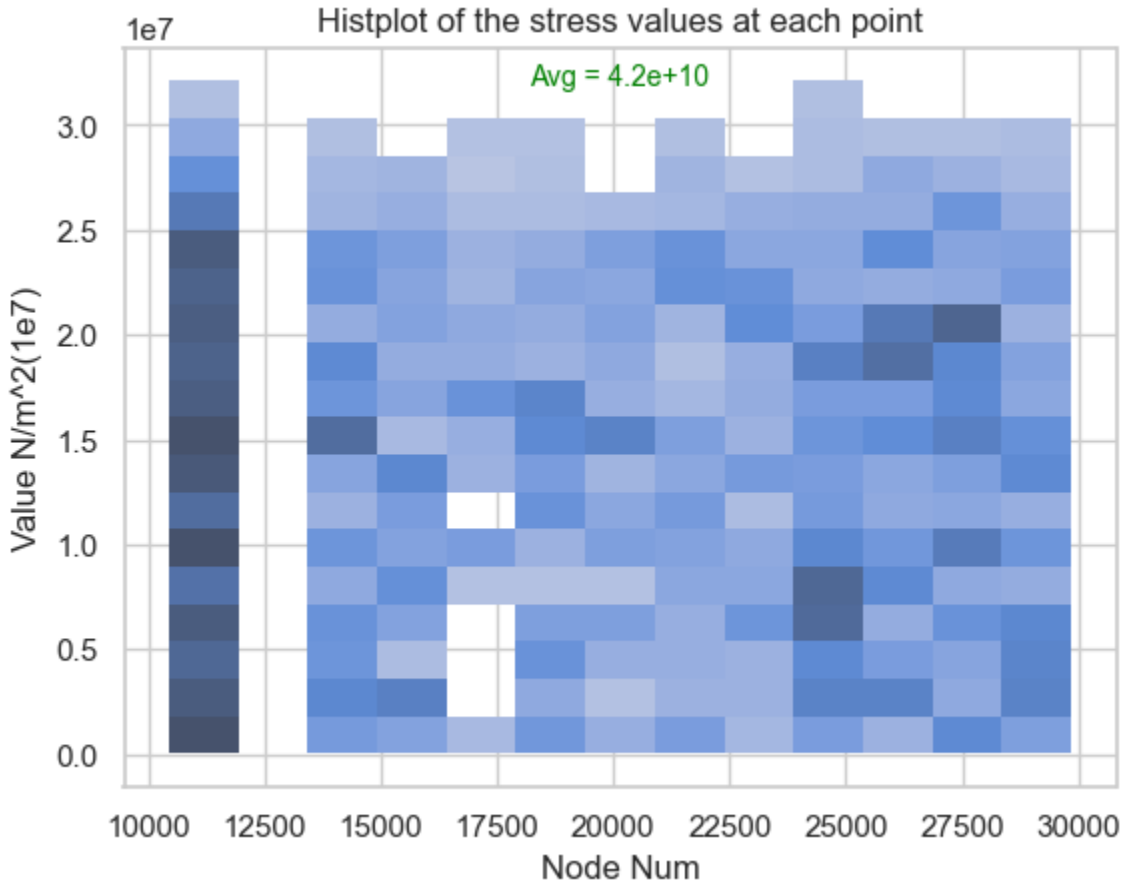
Out[15]:

	Node	Value (N/m^2)	X (mm)	Y (mm)	Z (mm)	Components
0	10444	17200.0	64.865	82.886	-6.7831	lumbar extension-1
1	10445	11600.0	64.865	73.527	-9.8691	lumbar extension-1
2	10446	29800000.0	-233.140	77.362	-12.4870	lumbar extension-1
3	10447	26700000.0	-233.140	82.886	-6.7831	lumbar extension-1
4	10503	18800.0	64.865	81.567	-4.0776	lumbar extension-1

In [16]:
```
# define as pandas data frame and then extracts vars
df=pd.DataFrame(df)
Node = list(df.iloc[:,0])
Value = list(df.iloc[:,1])
```

In [17]:
```
#Plot the histogram
ax= sns.histplot(x=Node,y=Value, data=df)
sns.set(style='whitegrid')
ax.annotate(f'Avg = 4.2e+10', xy=(0.5,0.95), xycoords='axes fraction', ha='center',fonts
ax.set_title('Histplot of the stress values at each point')
ax.set(xlabel='Node Num',ylabel='Value N/m^2(1e7)')
```

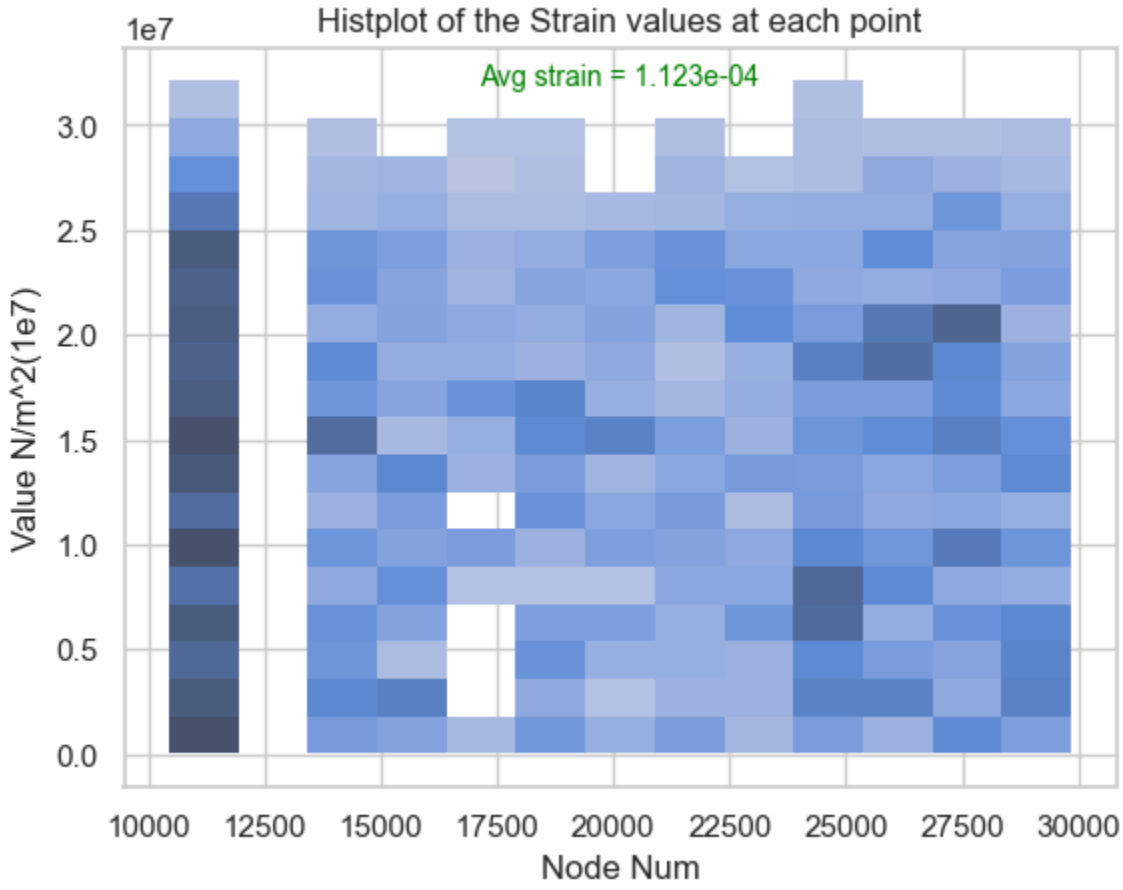
Out[17]:
```
[Text(0.5, 0, 'Node Num'), Text(0, 0.5, 'Value N/m^2(1e7)')]
```



In [18]:
```
Element = list(df.iloc[:,0])
Value2 = list(df.iloc[:,1])
```

In [19]:
```
#Plot the histogram
ax= sns.histplot(x=Element,y=Value2, data=df)
sns.set(style='whitegrid')
ax.annotate(f'Avg strain = 1.123e-04', xy=(0.5,0.95), xycoords='axes fraction', ha='cent
ax.set_title('Histplot of the Strain values at each point')
ax.set(xlabel='Node Num',ylabel='Value N/m^2(1e7)')
```

Out[19]:
```
[Text(0.5, 0, 'Node Num'), Text(0, 0.5, 'Value N/m^2(1e7)')]
```

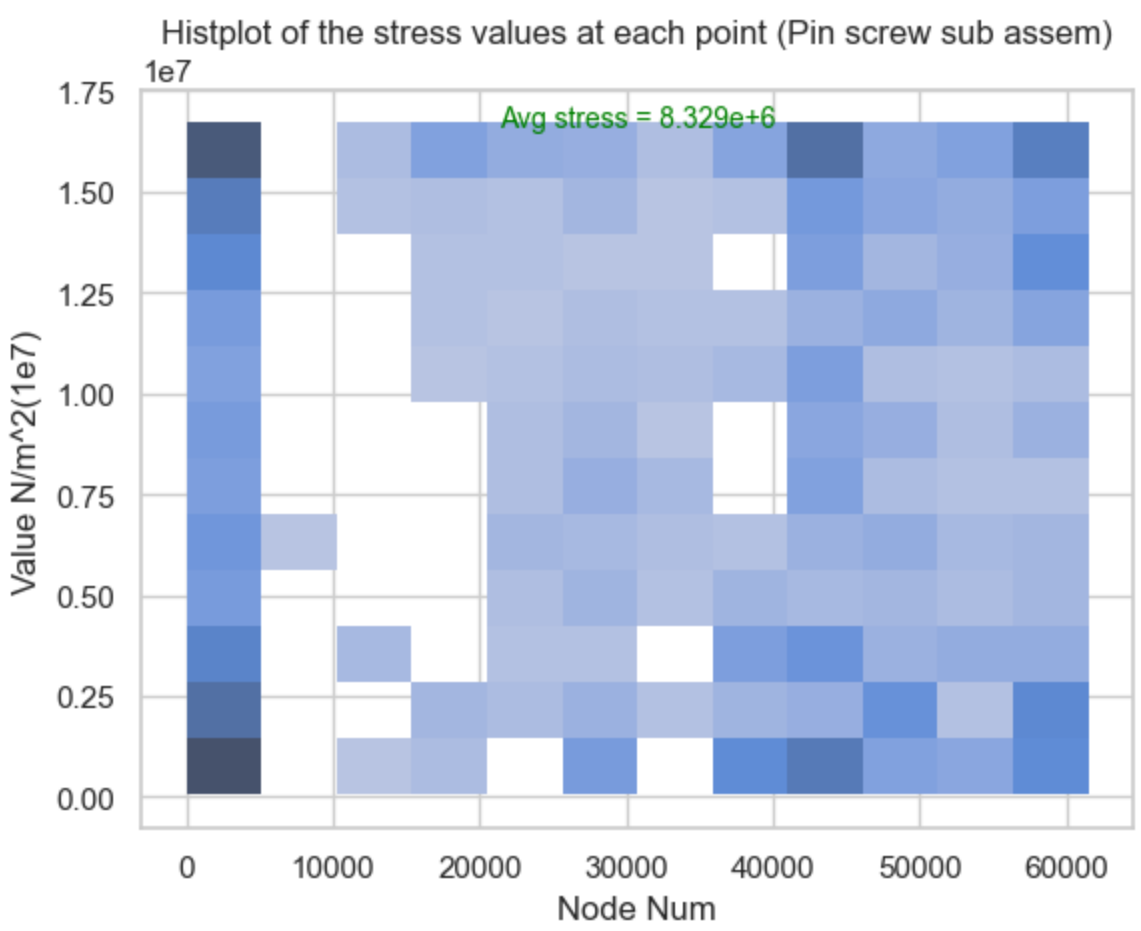


Now we performed a stress and strain force test on the hook screw sub assembly

First stress

In [20]:
```
df = pd.read_csv('subassem1-Static 1-Results-Stress1-3.csv')
# define as pandas data frame and then extracts vars
df=pd.DataFrame(df)
Node = list(df.iloc[:,0])
Value = list(df.iloc[:,1])
#Plot the histogram
ax= sns.histplot(x=Node,y=Value, data=df)
sns.set(style='whitegrid')
ax.annotate(f'Avg stress = 8.329e+6', xy=(0.5,0.95), xycoords='axes fraction', ha='cente
ax.set_title('Histplot of the stress values at each point (Pin screw sub assem)')
ax.set(xlabel='Node Num',ylabel='Value N/m^2(1e7)')
```

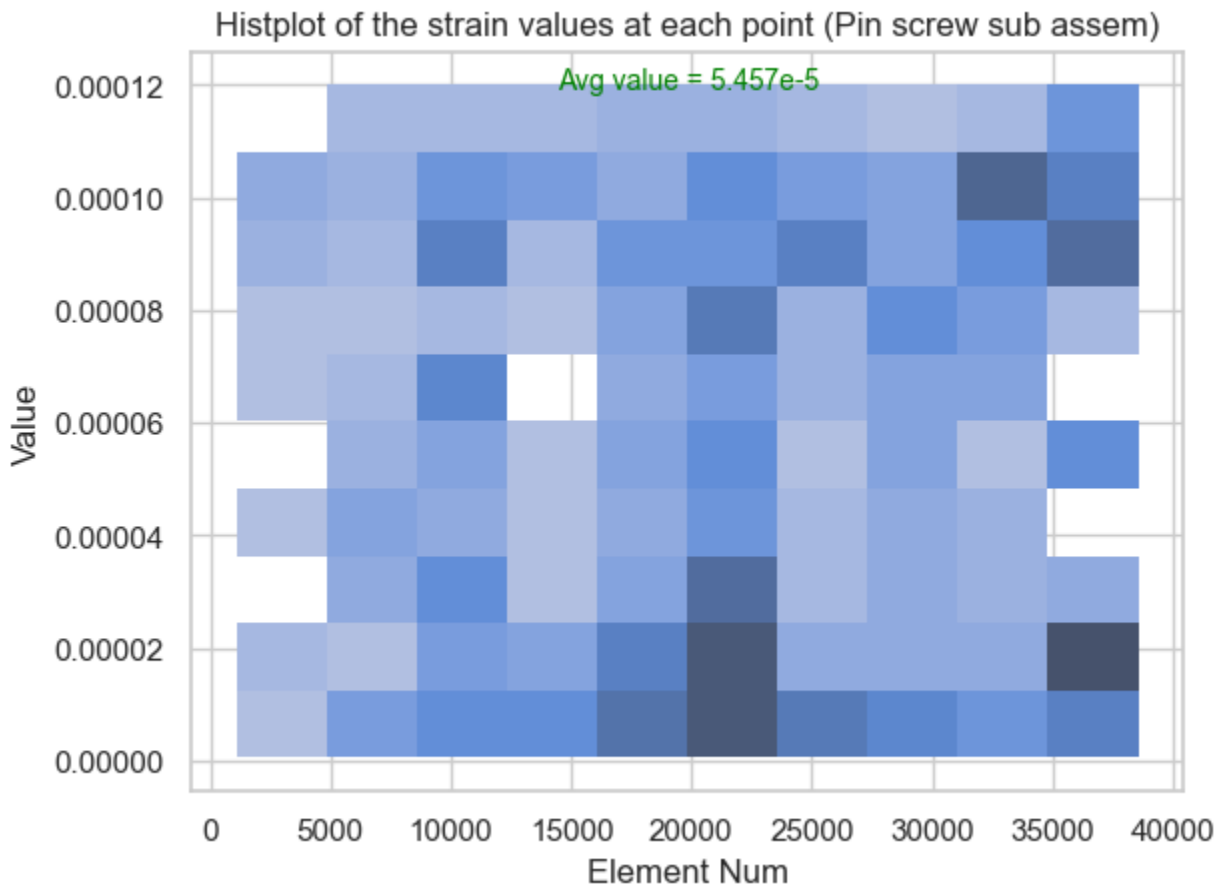
Out[20]:
```
[Text(0.5, 0, 'Node Num'), Text(0, 0.5, 'Value N/m^2(1e7)')]
```



Now for strain

In [21]:
```
df = pd.read_csv('subassem1-Static 1-Results-Strain1-4.csv')
# define as pandas data frame and then extracts vars
df=pd.DataFrame(df)
Element = list(df.iloc[:,0])
Value = list(df.iloc[:,1])
#Plot the histogram
ax= sns.histplot(x=Element,y=Value, data=df)
sns.set(style='whitegrid')
ax.annotate(f'Avg value = 5.457e-5', xy=(0.5,0.95), xycoords='axes fraction', ha='center
ax.set_title('Histplot of the strain values at each point (Pin screw sub assem)')
ax.set(xlabel='Element Num',ylabel='Value')
```

Out[21]:
```
[Text(0.5, 0, 'Element Num'), Text(0, 0.5, 'Value')]
```



These images provide a good overview of how the parts respond to stress and apply to anyone that wants a quick overview of the strength of the parts in their assembled form