



[illegible]

```

u041f\\u0440\\u043e\\u0447\\u043d\\u043e\\u0441\\u0442\\u044c \\
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\\\"description\\\": \\\"\\\"\\n          }\\n      }\\n  ]\\
n}\\\", \"type\": \"dataframe\", \"variable_name\": \"X_bp\"}

```

```

X_nup = pd.read_excel('/content/drive/MyDrive/DatasetsVKR/X_nup.xlsx')
# датасет с характеристиками углепластика
X_nup.drop('Unnamed: 0', axis = 1, inplace=True) # избавляемся от
лишнего столбца индексов
print(X_nup.shape) # выводим размерность 2го датасета
X_nup.head()

```

```
(1040, 3)
```

```

{"summary": "{\\n  \\\"name\\\": \\\"X_nup\\\",\\n  \\\"rows\\\": 1040,\\n
\\\"fields\\\": [\\n    {\\n      \\\"column\\\": \\\"\\u0423\\u0433\\u043e\\u043b\\
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\\\"num_unique_values\\\": 1006,\\n        \\\"samples\\\": [\\n
9.90150443857602,\\n        7.19065011209914\\n        ],\\n
\\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n      }\\
n    },\\n    {\\n      \\\"column\\\": \\\"\\u041f\\u043b\\u0442\\
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```

```
67.7188963415148,\n          50.8236748784086\n          ],\n  \"semantic_type\": \"\", \n          \"description\": \"\"\n  }\n  }\n  ]\n}\", \"type\": \"dataframe\", \"variable_name\": \"X_nup\"}
```

Согласно условию задания, необходимо замерджить датасеты по типу объединения INNER

```
df_X = X_bp.merge(X_nup, left_index = True, right_index = True, how =
'inner')
print(f'Итоговый датасет имеет размерность {df_X.shape}, на
первоначальном этапе обработки данных было отброшено {X_nup.shape[0] -
df_X.shape[0]} строк из 2го датасета')
df_X.head()
```

Итоговый датасет имеет размерность (1023, 13), на первоначальном этапе обработки данных было отброшено 17 строк из 2го датасета

```
{\"summary\": \"{\\n  \\\"name\\\": \\\"df_X\\\",\\n  \\\"rows\\\": 1023,\\n  \\\"fields\\\":
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7	Модуль упругости при растяжении, ГПа	1023	non-null	float64
8	Прочность при растяжении, МПа	1023	non-null	float64
9	Потребление смолы, г/м2	1023	non-null	float64
10	Угол нашивки, град	1023	non-null	int64
11	Шаг нашивки	1023	non-null	float64
12	Плотность нашивки	1023	non-null	float64

dtypes: float64(12), int64(1)

memory usage: 111.9 KB

df\_X.isnull().sum()

Соотношение матрица-наполнитель	0
Плотность, кг/м3	0
модуль упругости, ГПа	0
Количество отвердителя, м.%	0
Содержание эпоксидных групп,%_2	0
Температура вспышки, С_2	0
Поверхностная плотность, г/м2	0
Модуль упругости при растяжении, ГПа	0
Прочность при растяжении, МПа	0
Потребление смолы, г/м2	0
Угол нашивки, град	0
Шаг нашивки	0
Плотность нашивки	0

dtype: int64

*# все переменные имеют тип float64/int64, качественных характеристик и пробелов в датасете нет*

*df\_X.nunique() # количество уникальных значений по каждому из параметров*

Соотношение матрица-наполнитель	1014
Плотность, кг/м3	1013
модуль упругости, ГПа	1020
Количество отвердителя, м.%	1005
Содержание эпоксидных групп,%_2	1004
Температура вспышки, С_2	1003
Поверхностная плотность, г/м2	1004
Модуль упругости при растяжении, ГПа	1004
Прочность при растяжении, МПа	1004
Потребление смолы, г/м2	1003
Угол нашивки, град	2
Шаг нашивки	989
Плотность нашивки	988

dtype: int64

*# из всех параметров примечателен угол нашивки - у него всего 2 уникальных значения*

*df\_X['Угол нашивки, град'].unique()*

*array([ 0, 90])*

```
df_X['Угол нашивки, град'] = df_X['Угол нашивки, град'].replace({0.0:
0, 90.0: 1}).astype(int) # заменяем значения градусов на целые числа 0
и 1
df_X = df_X.rename(columns={'Угол нашивки, град' : 'Угол нашивки',
'модуль упругости, ГПа' : 'Модуль упругости, ГПа'}) # так как мы
теперь имеем дело не с градусами в качестве единицы измерения,
изменяем название соответствующего столбца
df_X
```

[illegible]



[illegible]

```
190.875279016224\n    ],\n    \"semantic_type\": \"\",\n    \"description\": \"\",\n    \"column\": \"u0423\\u043e\\u043b\\u043d\\u0430\\u0448\\u0432\\u043a\\u0438\", \n    \"properties\": {\n        \"dtype\": \"number\", \n        \"std\": 0, \n        \"min\": 0, \n        \"max\": 1, \n        \"num_unique_values\": 2, \n        \"samples\": [\n            1, \n        ], \n        \"semantic_type\": \"\", \n        \"description\": \"\", \n        \"column\": \"u0428\\u0430\\u043d\\u043d\\u0448\\u0432\\u043a\\u0438\", \n        \"properties\": {\n            \"dtype\": \"number\", \n            \"std\": 2.5634670728338826, \n            \"min\": 0.0, \n            \"max\": 14.4405218753969, \n            \"num_unique_values\": 989, \n            \"samples\": [\n                8.56581217318028, \n                2.2156519282891\n            ], \n            \"semantic_type\": \"\", \n            \"description\": \"\", \n            \"column\": \"u041f\\u043b\\u043e\\u0442\\u043d\\u0441\\u044c\\u043d\\u0448\\u0432\\u043a\\u0438\", \n            \"properties\": {\n                \"dtype\": \"number\", \n                \"std\": 12.350968798651312, \n                \"min\": 0.0, \n                \"max\": 103.988901301494, \n                \"num_unique_values\": 988, \n                \"samples\": [\n                    43.9076879570936, \n                    41.2464520255753\n                ], \n                \"semantic_type\": \"\", \n                \"description\": \"\", \n            }\n        }\n    ], \n    \"type\": \"dataframe\", \n    \"variable name\": \"df X\"}
```

## # проверка на наличие дубликатов

```
dpl = df.X.duplicated().sum()
```

```
if dpl == 0:
```

```
print('Дубликатов нет')
```

```
else:
```

```
print(f'Количество дубликатов в датасете: {dpl}')
```

Дубликатов нет

## # отображение гистограмм распределения параметров

# размер сетки

$$r = 7$$

C = 7

```
pl c = 1 # счетчик
```

```
plt.figure(figsize = (40, 40))
```

```
for col in df.X.columns:
```

```
plt.subplot(r, c, pl_c)
```

```
sns.histplot(data = df[X[col]], kde=True, color=(0.9, 0, 0.8))
```

```
plt.xlabel(None)
```

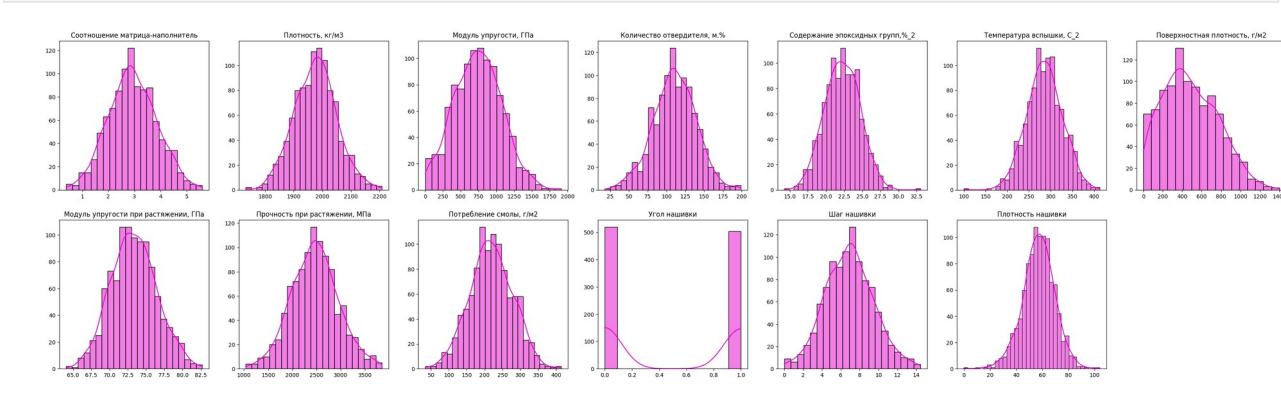
```
plt.ylabel(None)
```

```
plt.title(col, size = 12)
```

```
pl c += 1
```

# можно предположить наличие выбросов у параметров плотности,

содержания эпоксидных групп, температуры вспышки и плотности нашивки # визуально все параметры, за исключением угла нашивки, приближены к нормальному распределению



```
# "Необходимо также для каждой колонке получить среднее, медианное значение"
```

```
df_X.describe().loc[['mean', '50%']]
```

# для большинства параметров (кроме поверхностной плотности и угла нашивки) средние и медианные значения очень близки, что указывает на симметричное распределение данных

```
{ "summary": "{\n  \"name\": \"# \\u0043\\u004b\\u004f \\u0043\\u004e\\u004b\\u004c\\u0048\\u0038\\u003d\\u0041\\u0042\\u0043\\u0030 \\u004f\\u0030\\u0040\\u0030\\u003c\\u0035\\u0042\\u0040\\u003e\\u0032(\\u0043\\u0040\\u0043e\\u003c\\u0035 \\u004f\\u003e\\u0032\\u0035\\u0040\\u0045\\u003d\\u003e\\u0041\\u0042\\u003d\\u003e\\u0039 \\u004f\\u003b\\u003e\\u0042\\u003d\\u003e\\u0041\\u0042\\u0038 \\u0038\\u0043\\u003b\\u0030 \\u003d\\u0030\\u0048\\u0032\\u0043\\u0038) \\u0041\\u0040\\u0035\\u0034\\u003d\\u0038\\u0035 \\u0038 \\u003c\\u0035\\u0034\\u0030\\u003d\\u003d\\u004b\\u0035\\u0037\\u003d\\u0030\\u0047\\u0035\\u003d\\u0038\\u004f \\u003e\\u0047\\u0035\\u003d\\u004c \\u0031\\u003b\\u0038\\u0037\\u003a\\u0038, \\u0047\\u0042\\u003e \\u0043\\u003a\\u0030\\u0037\\u004b\\u0032\\u0030\\u0035\\u0042 \\u003d\\u0030 \\u0041\\u0038\\u003c\\u003c\\u0035\\u0042\\u0040\\u0038\\u0047\\u003d\\u003e\\u0035 \\u0040\\u0030\\u0041\\u003f\\u0040\\u0035\\u0034\\u0035\\u003b\\u0035\\u003d\\u0038\\u0035 \\u003d\\u003d\\u004b\\u0045\", \n  \"rows\": 2, \n  \"fields\": [\n    {\n      \"column\": \"\\u0042\\u004e\\u003e\\u0042\\u003d\\u003e\\u0048\\u0035\\u003d\\u0038\\u0035\\u003c\\u0030\\u0042\\u0040\\u0043\\u0038\\u0046\\u0030-\\u003d\\u0030\\u004f\\u003e\\u003b\\u003d\\u0038\\u0042\\u0035\\u003b\\u004c\", \n      \"properties\": {\n        \"dtype\": \"number\", \n        \"std\": 0.016608611119472427, \n        \"min\": 2.90687765033521, \n        \"max\": 2.9303657734325483, \n        \"num_unique_values\": 2, \n        \"samples\": [\n          2.90687765033521, \n          2.9303657734325483\n        ], \n        \"semantic_type\": \"\", \n        \"description\": \"\" \n      }, \n      \"column\": \"\\u0041\\u003b\\u003e\\u0042\\u003d\\u003e\\u0041\\u0042\\u004c,\"
```

```

u043a\\u0433/\\u043c3\\",\\n        \\\"properties\\\": {\\n            \\\"dtype\\\":
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\\\"num_unique_values\\\": 2,\\n            \\\"samples\\\": [\\n
1977.62165679058,\\n            1975.7348881101545\\n            ],\\n
\\\"semantic_type\\\": \\\"\\\",\\n            \\\"description\\\": \\\"\\\"\\n        }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u041c\\u043e\\u0434\\u0443\\
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u0442\\u0438, \\u0413\\u041f\\u0430\\\",\\n        \\\"properties\\\": {\\n
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\\\"min\\\": 739.664327697792,\\n        \\\"max\\\": 739.9232327560721,\\n
\\\"num_unique_values\\\": 2,\\n        \\\"samples\\\": [\\n
739.664327697792,\\n        739.9232327560721\\n        ],\\n
\\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n    }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u041a\\u043e\\u043b\\u0438\\
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u0435\\u0440\\u0434\\u0438\\u0442\\u0435\\u043b\\u044f, \\u043c.%\\\",\\n
\\\"properties\\\": {\\n        \\\"dtype\\\": \\\"number\\\",\\n        \\\"std\\\":
0.004192261660671894,\\n        \\\"min\\\": 110.564839894065,\\n
\\\"max\\\": 110.57076864736254,\\n        \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n        110.564839894065,\\n        110.57076864736254\\n
        ],\\n        \\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n    }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u0421\\u043e\\u0434\\u0435\\u0440\\u0436\\u0430\\u043d\\u0438\\u0435\\
\\u044d\\u043f\\u043e\\u043a\\u0441\\u0438\\u0434\\u044b\\u0445\\
\\u0433\\u0440\\u0443\\u043f\\u043f,%_2\\\",\\n        \\\"properties\\\": {\\n
\\\"dtype\\\": \\\"number\\\",\\n        \\\"std\\\": 0.009649031876369868,\\n
\\\"min\\\": 22.2307437560244,\\n        \\\"max\\\": 22.24438954776773,\\n
\\\"num_unique_values\\\": 2,\\n        \\\"samples\\\": [\\n
22.2307437560244,\\n        22.24438954776773\\n        ],\\n
\\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n    }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u0422\\u0435\\u043c\\u043f\\
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u043f\\u044b\\u0448\\u043a\\u0438, \\u0421_2\\\",\\n        \\\"properties\\\":
{\\n        \\\"dtype\\\": \\\"number\\\",\\n        \\\"std\\\":
0.010366878104705912,\\n        \\\"min\\\": 285.88215135162187,\\n
\\\"max\\\": 285.896812331237,\\n        \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n        285.88215135162187,\\n        285.896812331237\\n
        ],\\n        \\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n    }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u041f\\u043e\\u0432\\u0440\\u0445\\u043d\\u043e\\u0441\\u0442\\
u043d\\u0430\\u044f \\u043f\\u043b\\u043e\\u0442\\u043d\\u043e\\
u0441\\u0442\\u044c, \\u0433/\\u043c2\\\",\\n        \\\"properties\\\": {\\n
\\\"dtype\\\": \\\"number\\\",\\n        \\\"std\\\": 21.826595838581802,\\n
\\\"min\\\": 451.86436518306,\\n        \\\"max\\\": 482.73183303841853,\\n
\\\"num_unique_values\\\": 2,\\n        \\\"samples\\\": [\\n
451.86436518306,\\n        482.73183303841853\\n        ],\\n
\\\"semantic_type\\\": \\\"\\\",\\n        \\\"description\\\": \\\"\\\"\\n    }\\
n    },\\n    {\\n        \\\"column\\\": \\\"\\u041c\\u043e\\u0434\\u0443\\

```

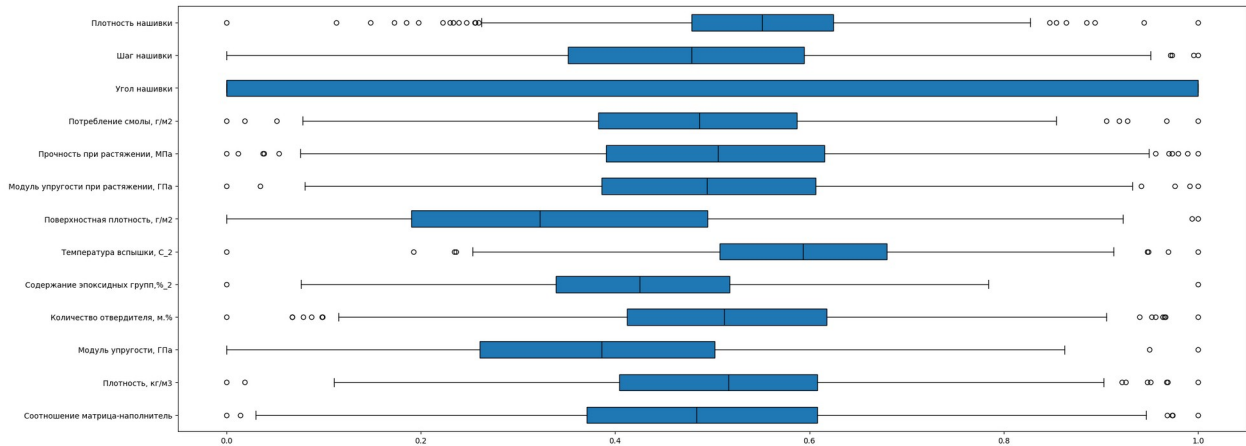
```

u043b\\u044c \\u0443\\u043f\\u0440\\u0443\\u0433\\u043e\\u0441\\
u0442\\u0438 \\u043f\\u0440\\u0438 \\u0440\\u0430\\u0441\\u0442\\
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\\\"max\\\": 73.32857125009068,\\n          \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n          73.2688045943481,\\n
73.32857125009068\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          },\\n          {\\n          \\\"column\\\": \\\"\\
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u043f\\u0440\\u0438 \\u0440\\u0430\\u0441\\u0442\\u044f\\u0436\\
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\\\"max\\\": 2466.922842697902,\\n          \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n          2459.52452600309,\\n
2466.922842697902\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          },\\n          {\\n          \\\"column\\\": \\\"\\
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0.548529966923402,\\n          \\\"min\\\": 218.42314367654285,\\n
\\\"max\\\": 219.198882195134,\\n          \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n          219.198882195134,\\n
218.42314367654285\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          },\\n          {\\n          \\\"column\\\": \\\"\\
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u043a\\u0438\\\",\\n          \\\"properties\\\": {\\n          \\\"dtype\\\":
\\\"number\\\",\\n          \\\"std\\\": 0.347678114307755,\\n          \\\"min\\\":
0.0,\\n          \\\"max\\\": 0.4916911045943304,\\n
\\\"num_unique_values\\\": 2,\\n          \\\"samples\\\": [\\n          0.0,\\n
0.4916911045943304\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          },\\n          {\\n          \\\"column\\\": \\\"\\
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\\\"samples\\\": [\\n          6.9161438559491,\\n
6.8992220776750175\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          },\\n          {\\n          \\\"column\\\": \\\"\\
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0.1329292966331075,\\n          \\\"min\\\": 57.153929432857645,\\n
\\\"max\\\": 57.3419198469929,\\n          \\\"num_unique_values\\\": 2,\\n
\\\"samples\\\": [\\n          57.3419198469929,\\n
57.153929432857645\\n          ],\\n          \\\"semantic_type\\\": \\\"\\\",\\n
\\\"description\\\": \\\"\\\"\\n          }\\n          }\\n          ],\\n          \\\"type\\\": \"dataframe\"}

```

```
# диаграммы "ящика с усами" - проверка на выбросы
```

```
sc = MinMaxScaler()  
sc.fit(df_X)  
plt.figure(figsize = (25, 10))  
plt.boxplot(pd.DataFrame(sc.transform(df_X)), labels = df_X.columns,  
patch_artist = True, vert = False, medianprops = dict(color =  
'black'))  
plt.show()
```

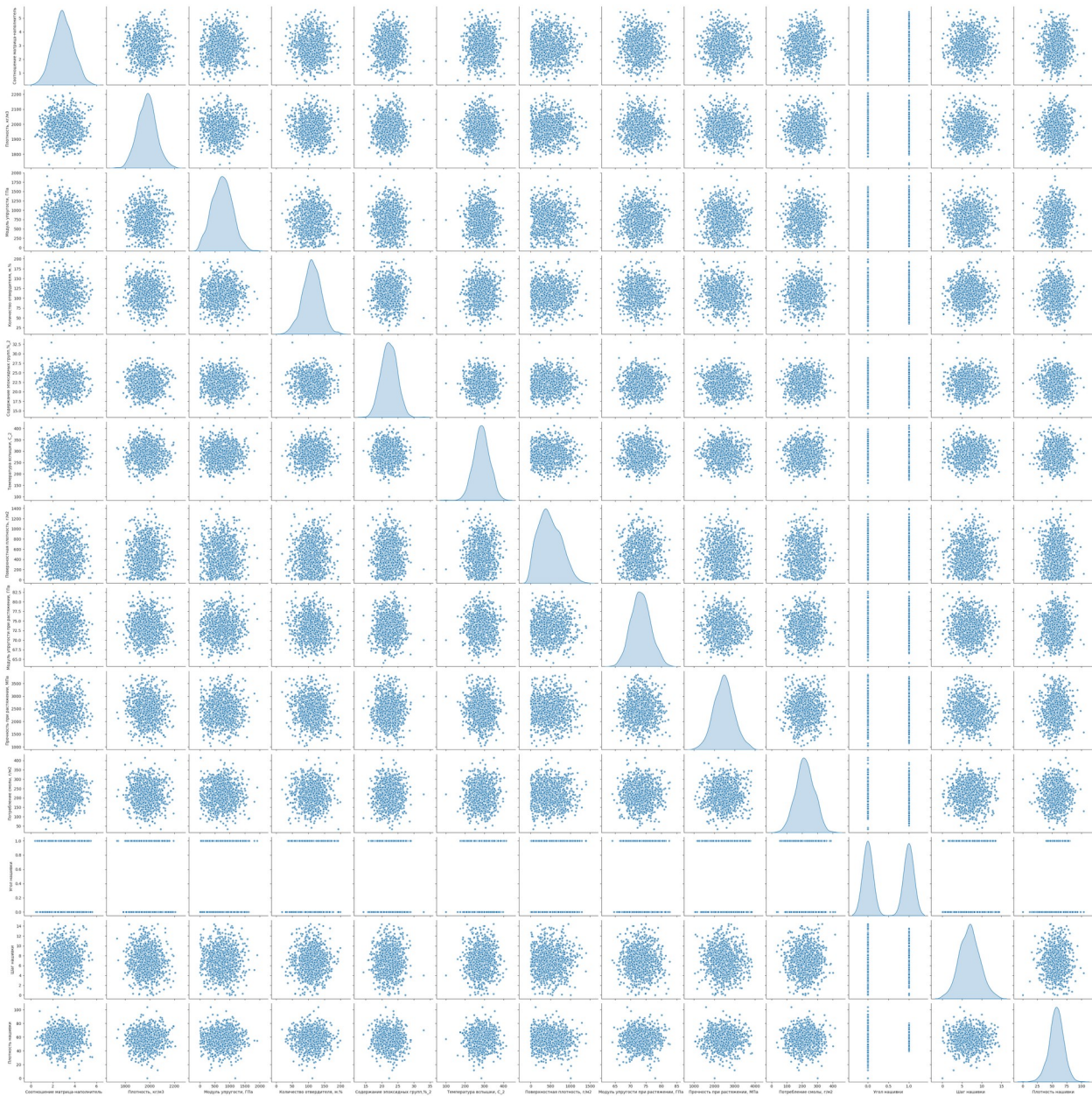


```
# как видно из диаграмм, выбросы присутствуют во всех параметрах  
(кроме угла нашивки), далее необходимо построить попарные графики  
рассеяния точек
```

```
sns.set_style('ticks')  
sns.pairplot(df_X,  
              diag_kind = 'kde', # использование ядерной оценки  
              # плотности на диагонали  
              kind = 'scatter', # тип графика рассеяния  
              plot_kws = dict(s=30, alpha=0.7, edgecolor="w",  
                               linewidth=1),  
              diag_kws = dict(shade=True), # параметры диагональных  
              # графиков  
              height = 3, # высота каждого подграфика  
              aspect = 1)
```

```
<seaborn.axisgrid.PairGrid at 0x79780f57ea10>
```





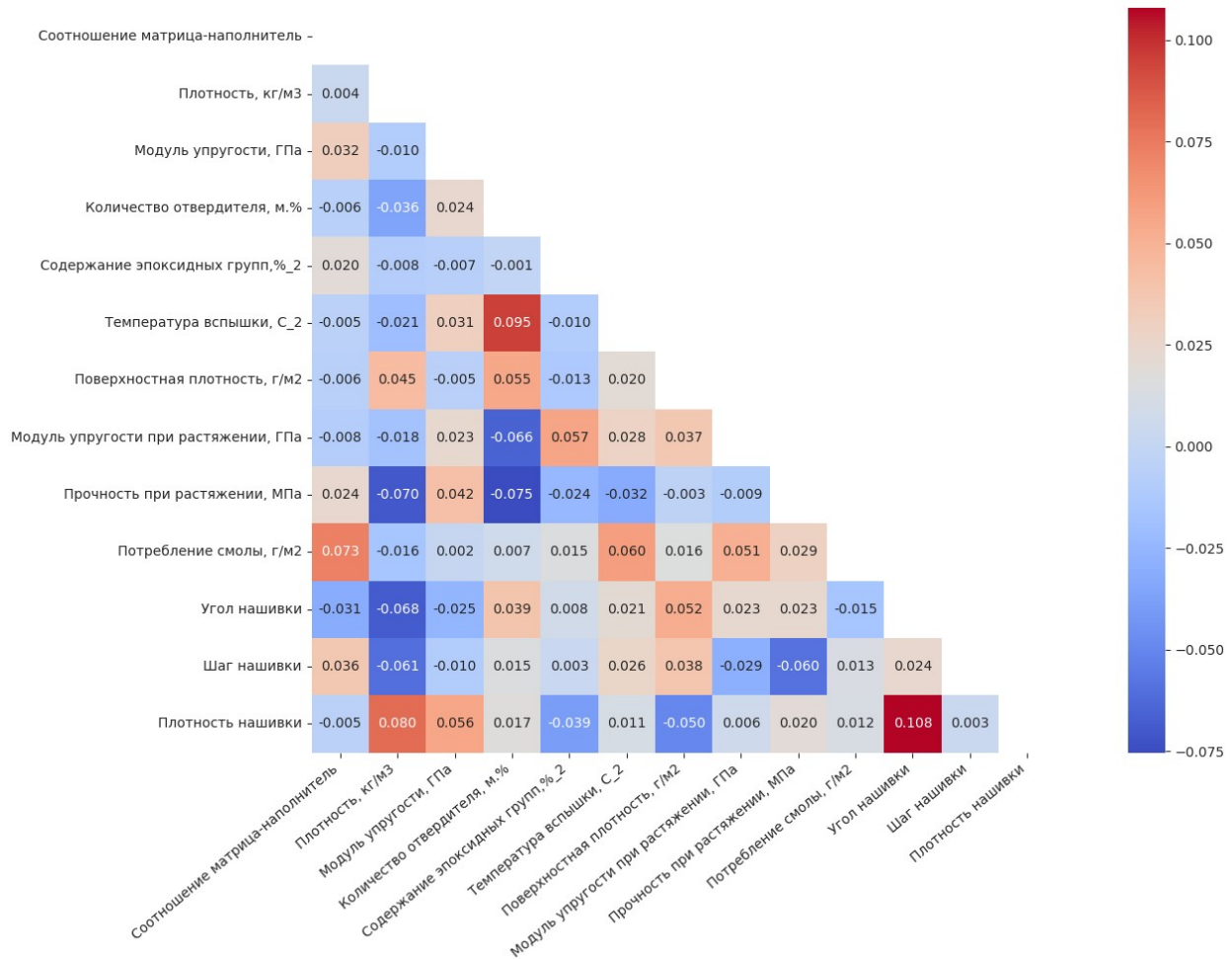
# как можно увидеть из графиков, не наблюдаются четкие линейные зависимости между парами параметров, то есть изменения одного параметра не приводят к пропорциональным изменениям другого параметра  
# построим тепловую корреляционную карту

```
plt.figure(figsize=(15, 10))
sns.heatmap(
    df_X.corr(),
    mask = np.triu(df_X.corr()),
    annot=True,
    fmt=".3f",
    square = True,
    cmap="coolwarm",
```

```

        cbar=True
    )
plt.xticks(rotation=40, ha = 'right')
plt.subplots_adjust(right=3)
plt.tight_layout()
plt.show()

```



# низкие значения (максимальное значение составляет 0,108 - корреляция между плотностью нашивки и углом нашивки) свидетельствуют об отсутствии сильных корреляционных связей между переменными

# метод 3-х сигм

```

def outliers_z_score(df_X):
    outliers = {}
    for column in df_X.columns:
        mean = df_X[column].mean()
        std_dev = df_X[column].std()
        z_scores = (df_X[column] - mean) / std_dev
        outliers[column] = len(z_scores[np.abs(z_scores) > 3])

```

```

    return outliers

# метод межквартильных расстояний (IQR)
def outliers_iqr(df_X):
    outliers = {}
    for column in df_X.columns:
        q1 = df_X[column].quantile(0.25)
        q3 = df_X[column].quantile(0.75)
        iqr = q3 - q1
        lower_bound = q1 - 1.5 * iqr
        upper_bound = q3 + 1.5 * iqr
        outliers[column] = len(df_X[(df_X[column] < lower_bound) |
(df_X[column] > upper_bound)])
    return outliers

outliers_z_score = outliers_z_score(df_X)
outliers_iqr = outliers_iqr(df_X)

comparison_df = pd.DataFrame({
    'Метод 3-х сигм': outliers_z_score,
    'Метод IQR': outliers_iqr
})

print("Результаты выявления выбросов:")
print(comparison_df)

```

Результаты выявления выбросов:

	Метод 3-х сигм	Метод IQR
Соотношение матрица-наполнитель	0	6
Плотность, кг/м3	3	9
Модуль упругости, ГПа	2	2
Количество отвердителя, м.%	2	14
Содержание эпоксидных групп, %_2	2	2
Температура вспышки, С_2	3	8
Поверхностная плотность, г/м2	2	2
Модуль упругости при растяжении, ГПа	0	6
Прочность при растяжении, МПа	0	11
Потребление смолы, г/м2	3	8
Угол нашивки	0	0
Шаг нашивки	0	4
Плотность нашивки	7	21

```

# метод межквартильных расстояний захватывает большую долю выбросов,
# нежели метод 3-х сигм, в связи с чем был выбран именно первый способ,
# отсекающий все выбросы
def remove_outliers_iqr(df_X):
    df = df_X.copy()
    for column in df.columns:
        q1 = df_X[column].quantile(0.25)
        q3 = df_X[column].quantile(0.75)

```





```

27.037890759871665,\n          \"min\": 38.6685003343557,\n
\"max\": 181.82844779488,\n          \"num_unique_values\": 919,\n
\"samples\": [\n          79.3468498323662,\n
107.549456408651,\n          115.168415221245\n          ],\n
\"semantic_type\": \"\", \n          \"description\": \"\", \n          }\n
n      },\n      {\n          \"column\": \"\\u0421\\u043e\\u0434\\u0435\\u0440\\u0436\\u0430\\u043d\\u0438\\u0435 \\u044d\\u043f\\u043e\\u043a\\u0441\\u0438\\u0434\\u044b\\u0445 \\u0433\\u0440\\u043f\\u043f,%_2\", \n          \"properties\": {\n
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\"min\": 15.6958938036288,\n          \"max\": 28.9550943746499,\n
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22.4632663490591\n          ],\n          \"semantic_type\": \"\", \n          }\n
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```





```

после - {df1.shape}, были удалены {df.shape[0] - df1.shape[0]}
выбросов')
print('\n')

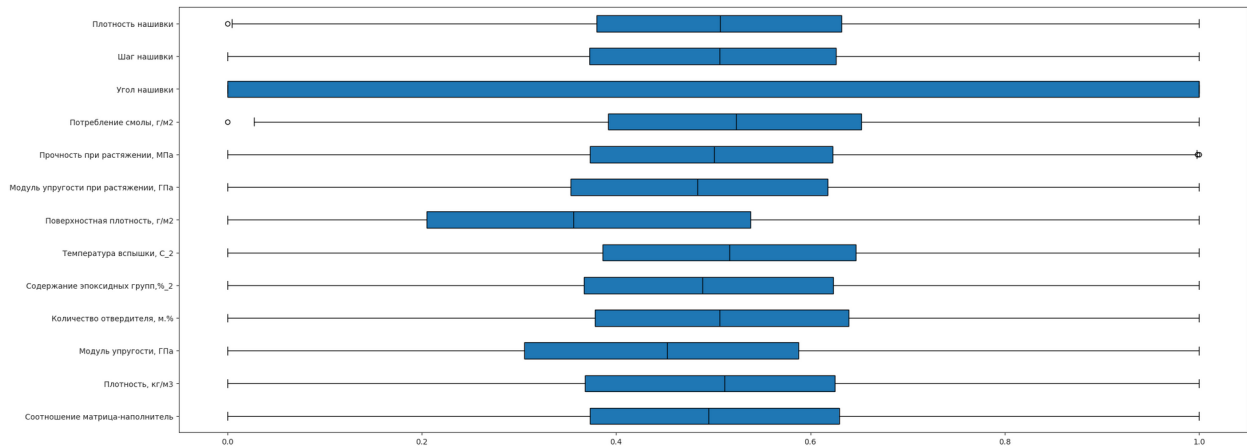
```

```

sc.fit(df1)
plt.figure(figsize = (25, 10))
plt.boxplot(pd.DataFrame(sc.transform(df1)), labels = df_X.columns,
patch_artist = True, vert = False, medianprops = dict(color =
'black'))
plt.show()

```

Размерность датасета до второго отсека выбросов (936, 13), после - (926, 13), были удалены 10 выбросов



*# большая часть выбросов была исключена, но они до сих пор присутствуют в датасете*

```

def remove_outliers_iqr(df1):
    df2 = df1.copy()
    for column in df.columns:
        q1 = df1[column].quantile(0.25)
        q3 = df1[column].quantile(0.75)
        iqr = q3 - q1
        lower_bound = q1 - 1.5 * iqr
        upper_bound = q3 + 1.5 * iqr
        df2 = df1[(df1[column] >= lower_bound) & (df1[column] <=
upper_bound)]
    return df2

df2 = remove_outliers_iqr(df1)

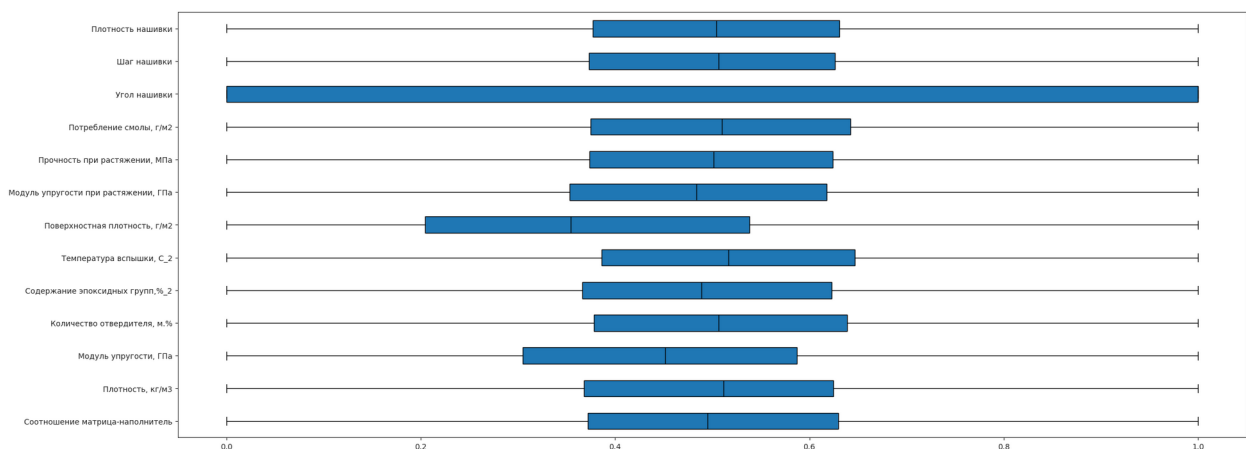
print(f'Размерность датасета до второго отсека выбросов
{df1.shape}, после - {df2.shape}, были удалены {df1.shape[0] -
df2.shape[0]} выбросов')

```

```
print('\n')

sc.fit(df2)
plt.figure(figsize = (25, 10))
plt.boxplot(pd.DataFrame(sc.transform(df2)), labels = df_X.columns,
patch_artist = True, vert = False, medianprops = dict(color =
'black'))
plt.show()
```

Размерность датасета до второго отсечения выбросов (926, 13), после - (922, 13), были удалены 4 выбросов



*# готово, теперь наш датасет не имеет выбросов*

```
df = df2
```

*# отобразим гистограммы каждого из параметров без нормализации, в исходных единицах*

```
r = 5
c = 5
pl_c = 1
plt.figure(figsize=(35,35))
for col in df.columns:
    plt.subplot(r, c, pl_c)
    sns.histplot(data = df[col], kde = True, color = "orange")
    plt.xlabel(None)
    plt.ylabel(None)
    plt.title(col, size = 15)
    pl_c += 1
```

*# все параметры стремятся к нормальному распределению (опять же, за исключением угла нашивки)*



```
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```

```

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```

```

a = df.describe()
a.T.loc[:, ['min', 'max']].drop(['Unnamed: 0'], axis = 0)

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```