15 deg

August 19, 2025

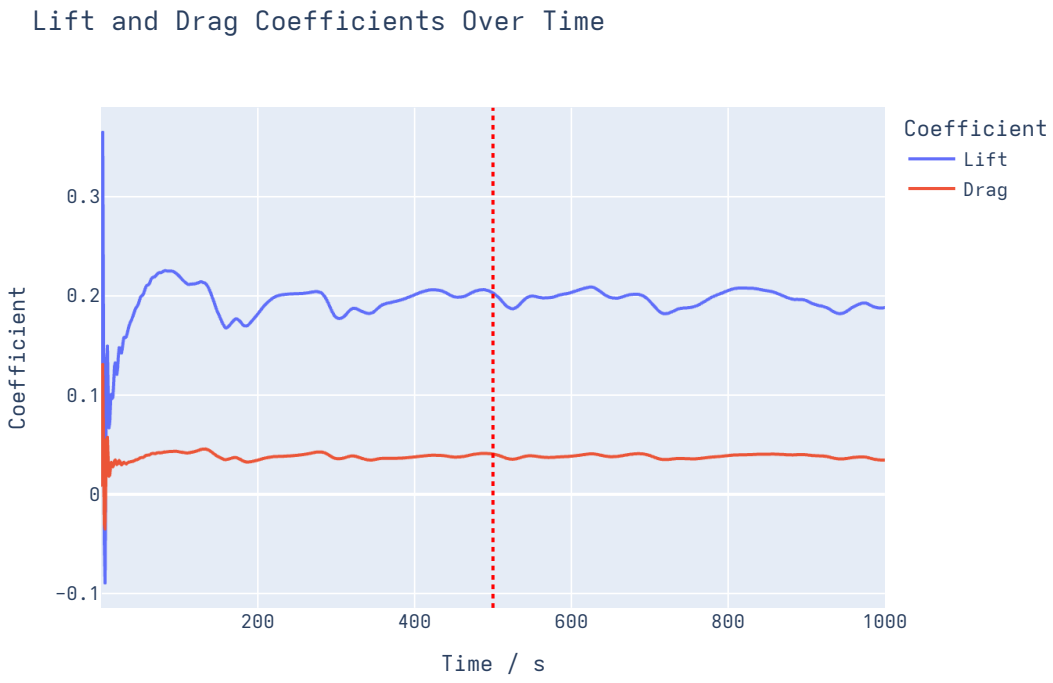
[9]:
```
import numpy as np
import pandas as pd
import plotly.express as px
import plotly.io as pio

pio.renderers.default = "notebook+pdf"
```

[10]:
```
file_name = input("Enter the CSV file name without file extension: ")
df = pd.read_csv(file_name + '.csv')

lift_values = df['FORCE_COEFFICIENT_CL']
drag_values = df['FORCE_COEFFICIENT_CD']
```

[11]:
```
# plot lift and drag against time
fig = px.line(df, x='Time (s)', y=['FORCE_COEFFICIENT_CL',␣
 ↪'FORCE_COEFFICIENT_CD'],
              labels={'value': 'Coefficient', 'Time (s)': 'Time / s'},
              title='Lift and Drag Coefficients Over Time')
fig.update_layout(legend_title_text='Coefficient', hovermode='x unified')
fig.for_each_trace(lambda t: t.update(name=t.name.
 ↪replace('FORCE_COEFFICIENT_CL', 'Lift').replace('FORCE_COEFFICIENT_CD',␣
 ↪'Drag')))
fig.add_shape(type="line", x0=500, y0=0, x1=500, y1=1, yref="paper",
              line=dict(color="Red", width=2, dash="dot"))
fig.show()
```



[12]:
```
# average after 500s to remove initial transient effects
df = df[df['Time (s)'] > 500]
lift_values = df['FORCE_COEFFICIENT_CL']
drag_values = df['FORCE_COEFFICIENT_CD']

average_lift = np.mean(lift_values)
average_drag = np.mean(drag_values)

print("From 500s onwards (to remove initial transient effects):")

print(f"Average Lift Coefficient: {average_lift:.3f}")
print(f"Average Drag Coefficient: {average_drag:.3f}")

# lift/drag ratio
lift_drag_ratio = average_lift / average_drag
print(f"Lift/Drag Ratio: {lift_drag_ratio:.3f}")
```

```
From 500s onwards (to remove initial transient effects):
Average Lift Coefficient: 0.196
Average Drag Coefficient: 0.038
Lift/Drag Ratio: 5.155
```