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import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Simulate vibration sensor data
np.random.seed(42)
time = np.arange(0, 100, 0.5) # time in
seconds
baseline_vibration = np.sin(0.2 * time)
+ np.random.normal(0, 0.2, len(time))

# Introduce anomaly (simulating damage)
anomaly_start = 120
anomaly = baseline_vibration.copy()
anomaly[anomaly_start:] +=
np.random.normal(1.5, 0.5,
len(anomaly[anomaly_start:]))

# Create DataFrame
df = pd.DataFrame({
    'Time (s)': time,
    'Baseline': baseline_vibration,
    'With Anomaly': anomaly
})

# Plotting with Seaborn and Matplotlib
sns.set(style='whitegrid')
plt.figure(figsize=(12, 6))
sns.lineplot(x='Time (s)', y='Baseline',
data=df, label='Normal Vibration')
sns.lineplot(x='Time (s)', y='With
Anomaly', data=df, label='Vibration with
Damage', color='red')
plt.axvline(x=time[anomaly_start],
color='black', linestyle='--',
label='Anomaly Detected')

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plt.axvline(x=time[anomaly_start],  
color='black', linestyle='--',  
label='Anomaly Detected')  
plt.title('Structural Health Monitoring:  
Vibration Over Time')  
plt.xlabel('Time (s)')  
plt.ylabel('Amplitude')  
plt.legend()  
plt.tight_layout()  
plt.show()
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