

To,

IITD-AIA Foundation of Smart Manufacturing

WEEK-1

Dear sir, Following is the required progress report to the best of my knowledge considering relevant topics and project objectives covered.

Learning and Implementation:

Learned about the topic Time Series Analysis and continued the study about Predictive Maintenance.

Time-Series Analysis: Bearings' degradation data is often collected over time, so understanding time-series analysis techniques will be beneficial. Explore methods like autoregressive integrated moving average (ARIMA), exponential smoothing, or recurrent neural networks (RNNs) for time-series forecasting.

Time-series analysis is a statistical technique used to analyze and interpret data points collected over time. It involves studying the patterns, trends, and dependencies within the data to make predictions and derive meaningful insights. Time-series analysis is particularly useful when dealing with data that has a temporal component, such as stock prices, weather data, sensor readings, or economic indicators.

Some key concepts and techniques in time-series analysis include:

Time-series data: Time-series data is a sequence of observations recorded at regular intervals over time. Each data point is associated with a specific timestamp or time period.

Trend: The trend represents the long-term movement or directionality of the data over time. It indicates whether the data is increasing, decreasing, or staying relatively constant.

Seasonality: Seasonality refers to recurring patterns or cycles that occur within the data at fixed intervals. It often occurs in data influenced by seasonal factors, such as sales data with monthly or yearly patterns.

Stationarity: A time series is said to be stationary if its statistical properties, such as mean, variance, and autocorrelation, remain constant over time. Stationary series are easier to model and analyze.

Autocorrelation: Autocorrelation measures the relationship between an observation and previous observations in a time series. It helps identify patterns and dependencies within the data.

Forecasting: Time-series analysis allows for forecasting future values based on historical data patterns and trends. Forecasting techniques include moving averages, exponential smoothing, and autoregressive integrated moving average (ARIMA) models.

Time-series models: Various models are used in time-series analysis to capture and explain the patterns and dependencies within the data. Some commonly used models include ARIMA, seasonal ARIMA (SARIMA), exponential smoothing models, and state space models.

Model evaluation: Evaluating the performance of time-series models is essential to ensure their accuracy and reliability. Common evaluation metrics include mean absolute error (MAE), mean squared error (MSE), root mean squared error (RMSE), and forecast error percentage.

And performed the implementation of Time-series analysis in kaggle using various programming languages and libraries such as Python with libraries like pandas, NumPy, statsmodels, and scikit-learn, or R with packages like forecast and ggplot2. These libraries provide functions and tools for data manipulation, visualization, modeling, and forecasting of time-series data.

Learned about Bearing Functionality and Failure modes and got some knowledge about bearings, their function in machinery, and common failure modes. Learned about the factors that contribute to bearing degradation and failure, such as load, speed, lubrication, temperature, and contamination.

Also got to know about some common failure modes of bearings like:

Fatigue Failure

Wear

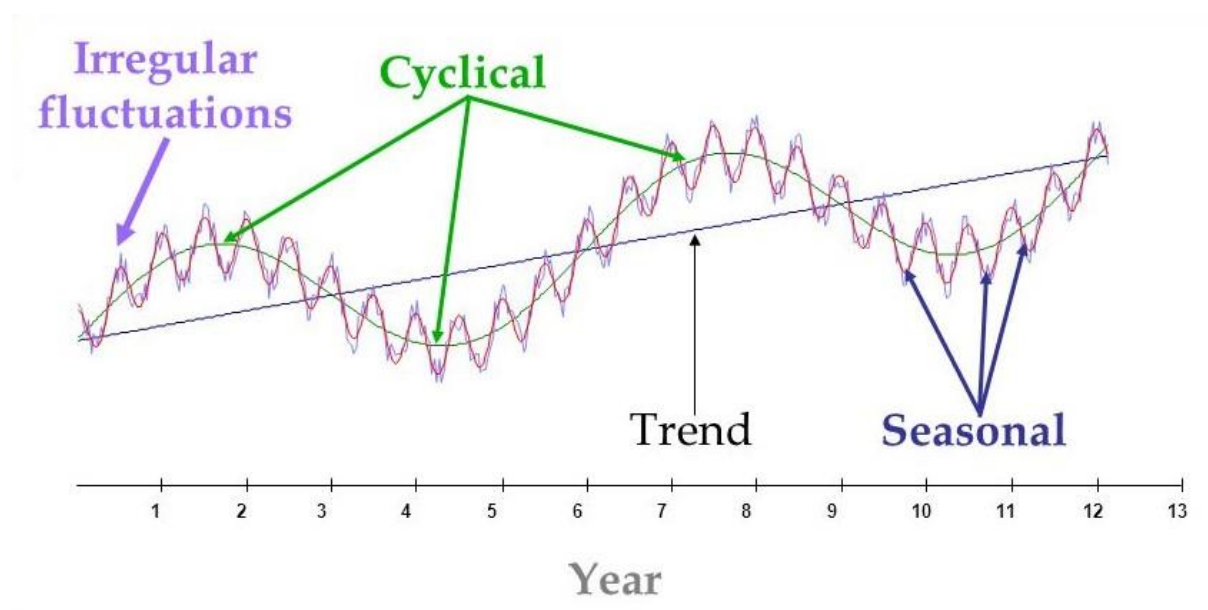
Corrosion

Overloading

Misalignment etc.

Explored methods like autoregressive integrated moving average (ARIMA), exponential smoothing, or recurrent neural networks (RNNs) for time-series forecasting.

Studied techniques for identifying anomalies or fault signatures in bearing data. This could involve statistical methods, signal processing techniques, or machine learning algorithms specifically designed for anomaly detection.



(Fig: Graphical representation of Time Series Analysis)

Practiced my learning about Time series Analysis in Kaggle and Implemented my learning in the Kaggle and got certificate on it.