Energy-SmartOps Integrated Control and Operation of Process, Rotating Machinery and Electrical Equipment

# APPLY INTELLIGENT METHODS FOR CONDITION ASSESSMENT AND DIAGNOSIS OF ELECTRICAL DRIVE SYSTEM

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Introduction

Condition assessment; is how you determine the present state of a system or component.

• Industry requirements have stimulated technology development in power electronics making it more affordable and accessible at all levels. Traditional and modern techniques of monitoring are responsible for extracting the condition assessment to prevent malfunctions that can lead to catastrophic consequences
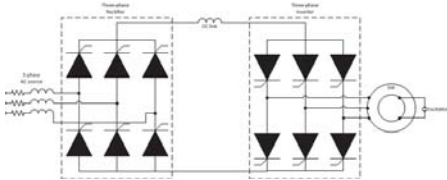
Problem statement

Direct using of machine measured signals and information collected in neural detectors is impossible and for sure ineffective. It might be related with ambiguous representation of magnitudes occurring in this object, size of the magnitude vector or occurring distortions. Properly designed measurement system does not solve these problems. It is necessary to use data preprocessing block (so called preprocessor) of which task is to transform measured signals to suitable form to be applied in the input of neural network

Task 1: Data acquisition

Data acquisition is a **process of collecting and storing useful data** (information) from targeted physical assets:

• so-called event data
• and condition monitoring data

CM; condition monitoring data are very versatile. It can be vibration data, acoustic data, oil analysis data, temperature, environment data, etc. Various sensors, such as micro-sensors, ultrasonic sensors, acoustic emission sensors, etc., have been designed to collect different types of data.
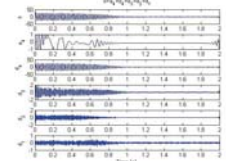
PREPROCESSING METHODS
Time-frequency analysis
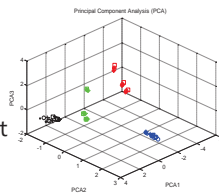• Short-time Fourier transform
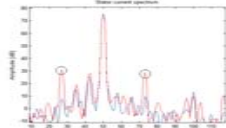
• Wavelet transform

Value type data analysis;
• PCA, principal component
• ICA, independent component

Task 2: Diagnostic algorithms

Data cleaning: important step, to avoid the so-called "garbage in garbage out" situation.
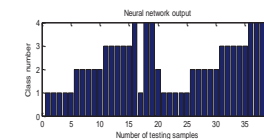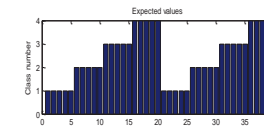
Data analysis: depend mainly on the types of data collected a variety of models, algorithms and tools are available.

CM data collected from the data acquisition step are versatile. It falls into three categories:
• Value type
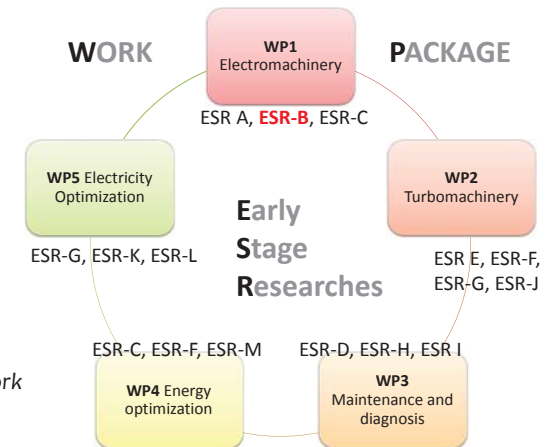• Waveform type
• Multidimensional type

AI APPROACHES
• *ANN, artificial neural Network*

AI techniques have been increasingly applied to machine diagnosis and have shown improved performance over conventional approaches. In practice, however, it is not easy to apply AI techniques due to the lack of efficient procedures to obtain training data and specific knowledge, which are required to train the models. In the literature, two popular AI techniques for machine diagnosis are artificial neural networks (ANNs) and ESs.

My project in SmartOps

WORK **PACKAGE**

WP1 Electromachinery
ESR A, **ESR-B**, ESR-C

WP5 Electricity Optimization
ESR-G, ESR-K, ESR-L

Early Stage Researches

WP2 Turbomachinery
ESR E, ESR-F, ESR-G, ESR-J

ESR-C, ESR-F, ESR-M

ESR-D, ESR-H, ESR I

WP4 Energy optimization

WP3 Maintenance and diagnosis

Future work

At the present I am designing a complete test-bench. The aim is generate enough data to create specific "knowledge" under different faults operations induced in a Condition Monitoring ready synchronous machine. This knowledge will provide adequate training data. All this knowledge will be used to generate AI-based on-line diagnostic algorithms.

REF: Andrew K.S. Jardine, Daming Lin, Dragan Banjevic, A review on machinery diagnostics and prognostics implementing condition-based maintenance, Mechanical Systems and Signal Processing, Volume 20, Issue 7, October 2006, Pages 1483-1510, ISSN 0888-3270, 10.1016/j.ymssp.2005.09.012.