Energy-SmartOps

**Integrated Control and Operation of Process, Rotating Machinery and Electrical Equipment**

MATHEMATICAL MODEL OF ELECTRO-MECHANICAL SYSTEMS WITH THE PURPOSE OF FAULTS DIAGNOSIS AND ANALYSIS

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HOW MY PROJECT FITS IN THE OVERALL GOALS OF THE PROJECT?

Energy efficiency and CO_2 reduction through control and operation processes strategies


ENERGY SMARTOPS STRATEGY
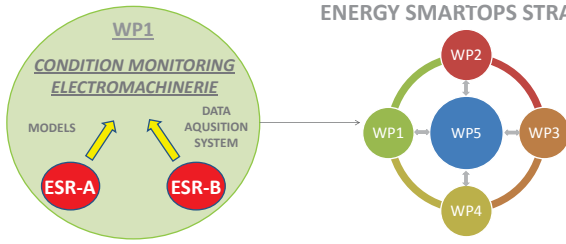
Prediction through analysis and diagnosis leads to value data used to decide control and operation strategies

MATHEMATICAL MODELLING OF ELECTRO-MECHANICAL SYSTEMS: WHAT AM I LOOKING FOR?

The frequency spectrum of the stator phase currents through Motor Current Signature Analysis techniques (MCSA).

The aim of my research is to find patterns of behavior of different frequencies that allow us to identify which type of fault is affecting the studied engine.
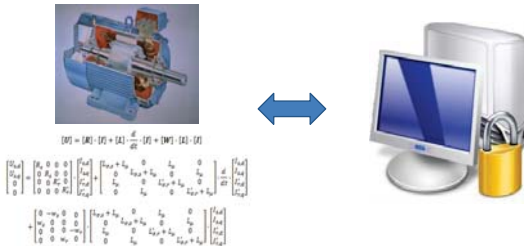
METHODOLOGY

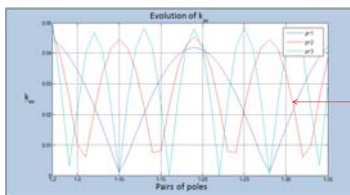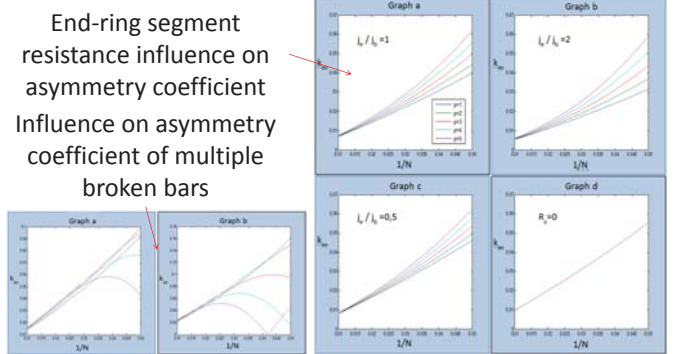**Modeling Electromechanical systems**

- Classical Induction Motor Model for Healthy machine
- Matrices of Resistance and Inductance of the motor under Fault condition
- Simplification of matrices using Symmetrical components or Park Matrix.
- Harmonic method Balance: stator currents in components D-Q
- Simulink model with exchangeable blocks, including library DTC controllers
- Fourier Series of Stator Phase Currents: Frequency domain
- Fourier Series of Stator Phase Currents: Frequency domain

Real data – Test Bench

- Healthy Machine
- Damaged rotors for Faulty cage and End bell rectified for eccentricities
- Data capture systems (ESR-B)
- Test of net supply and DTC controllers supply.
- Comparison of mathematical results vs. test bench data
- Conclusions

RESULTS SO FAR: "INFLUENCE OF DESIGN DATA OF INDUCTION MOTOR ON EFFECTS OF CAGE ASYMMETRY"

Faults cage diagnosis depends on the correct choice of the variable which, mathematically speaking represents the broken bar. In this paper that influence has been discussed, showing the effects of different assumptions that engineers usually use.

End-ring segment resistance influence on asymmetry coefficient
Influence on asymmetry coefficient of multiple broken bars

Influence on asymmetry coefficient of different pair broken bars in rotor with pole pair number p=1,2,3.

PRESENT AND FUTURE WORK
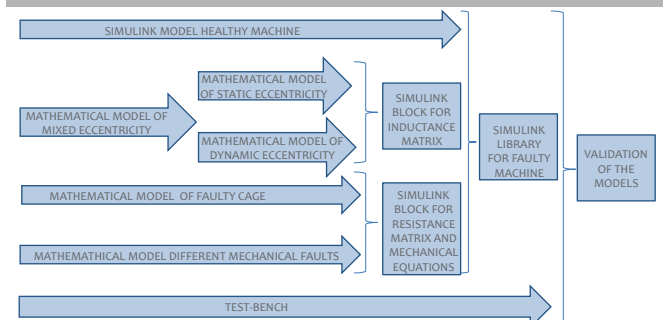
We are looking for an answer to the following main questions : *Will it be possible to identify different frequency bands for each combination of faults? How accurate will our diagnosis be?*

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