Incident and post-incident asset management for power energy supply

Context

The gains in optimal use of « aerial » power production and distribution systems rely on the capacity of estimating the energy production potential in any service conditions. The potential of use of equipment's structural components can be sorted into instantaneous and remaining energy supply potential. Each one is following a different time scale, regarding different scales of demand.

Energy production and distribution systems suffer more complex and demanding environmental conditions up to the point that they sometimes need to be either stopped or disconnected more often than initially designed or, even worse, they need to be early decommissioned.

Facing urgent situation or non-available replacement solutions, we need to consider to keep the systems

- in a downgraded mode: we keep the system producing the most it can by adapting its performances while slightly going beyond the recommended damage growth or fatigue indexes
- in degrading mode: we keep the system running to keep on delivering life-supporting necessary power during the environmental severe event, knowing that we accelerate the degradation of the structure.

Aim & Objectives of the Research idea

Description of the works

The aim of this PhD subject is the evaluation of energy production and distribution systems in incident and post-incident operating condition to ensure the continuity of power supply

- Therefore, we need to develop models predicting the power efficiency and its evolution with respect to the damage increase in structures like pylons and wind engine structures.
- In parallel, we need to develop damage index and dynamic evolution of ruin under harsh environmental loadings.
- Both model and damage index are the key element of an optimal management of power supply in post sever environmental event or technical incident to forecast the remaining useful life of the power distribution system with respect to its actual state.

These three points: modelling, damage index and optimal management of power supply can be considered as the three main chapters of the PhD project.

Specific to the current project

To be a little bit more specific, the PhD subject will address:

- Structural Health Monitoring using optic fibre sensors

- Damage model and dynamic evolution of damage in complex systems like electricity production and transfer structures

- Environmental loads and constraints modelling to which pylons and mechanical superstructures are submitted to.

- Edge computing and modelling of structural behaviour in sparse data conditions like distributed sensing systems on large structure networks

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