Generator bearing defect development based on discrete fault stages

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Introduction

CMS is employed by OEM and O&O as part of the condition based maintenance strategy, both in onshore and offshore wind farms. The main objectives are:
1. Reduce cost of energy (CoE)
2. Increase energy and time availability
3. Optimize maintenance and component replacement

Commonly, vibration-based CMS is applied on monitoring of the main drive-train components and tower oscillations.

Generator bearing monitoring

Monitoring of generator bearings is performed by radially installed accelerometers close to the load zone. A wide variety of faults is detectable, such as
- subcomponents defects (ball, cage, inner & outer race)
- rotor dynamic faults (imbalance, misalignment, looseness)
- slip ring unit malfunction in DFIGs

Development of bearing faults

Data set consists of:
- 119 bearing defects (mainly BPFI), which have lead to
- 340 alarm reports of various severity.

The main observations are:
- Sev4 → Sev3: 80% of faults are upgraded within 10 months - 60% within 4 months
- Sev3 → Sev2: 80% of faults are upgraded within 4 months - 60% within 2 months
- Sev2 → Sev1: 85% of faults are upgraded within 2 months

Severity estimation

B&K Vibro CMS combines an automated alarm generation system with operator interaction in alerting, diagnosing and evaluating the severity of a developing fault. Four discrete severity levels are employed, providing suggestions on the criticality of a fault and lead time to inspection and planning of any required maintenance needs.

Conclusions

- Fault progression is faster as higher severity levels are reached
- Upgrade time is consistent with provided lead time