

Paper 12: Development of a Sound Analysis Tool for Pre-Diagnosis of Mechanical Failure

Authors: Lukas Selonke Klaas (WEG), Haral Jonas Serafini (WEG)

Abstract:

Early detection of mechanical faults in rotating machinery prevents unplanned downtime and reduces maintenance costs. Traditional vibration analysis remains the reference method, but it requires dedicated sensors and data acquisition systems that are not always available in the field. This paper presents a smartphone-based sound analysis method for pre-diagnosis of faults, focusing on audible acoustics (20 Hz–20 kHz) as a practical, low-cost complement to vibration analysis. We describe an end-to-end workflow—acquisition, preprocessing, feature extraction, fault indicators, and decision logic—implemented in Python. Two case studies are included: (i) a wind-turbine pitch drive with suspected planetary stage issues, and (ii) an electric motor with bearing tones consistent with BPFO/BPFI. Results show that sound spectra, envelopes, and time–frequency maps can reveal consistent spectral components associated with gear mesh and rolling bearing kinematics, enabling consistent field triage and decision-making when vibration tools are unavailable. We discuss the advantages and limitations. The proposed approach does not replace vibration analysis; instead, it bridges the gap between qualitative listening and instrumented diagnostics, accelerating triage and decision-making in the field.