

# Spectral Approaches to Non-Intrusive Load Monitoring

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The Non-Intrusive Load Monitor (NILM) is a system that monitors, records and processes voltage and current measurements to establish the operating characteristics of individual loads. The NILM can also be used to actively monitor degradation or diagnose specific system failures. Current NILM research conducted at Massachusetts Institute of Technology's Laboratory for Electromagnetic and Electronic Systems (LEES) is exploring the application and expansion of NILM technology for the use of monitoring a myriad of electromechanical loads. This thesis presents a fundamental NILM operation explanation using an "Ideal Machine," concept and demonstrates its potential to detect an array of electric machine failures before they become catastrophic. The NILM's ability to monitor the current spectrum of electric machines can be used to immediately diagnose multiple common system casualties and detect unusual system operation.

Current versions of the NILM identify loads simply by looking at transient patterns and steady-state power changes. This may not be enough when you're looking at multiple systems. One option that will be investigated is the use of system spectral information. Analogous to the mechanical vibration monitoring, the electrical spectral information presents a greater potential for multi-system remote monitoring and overall cost savings. Measurements and experimentation were conducted in the LEES laboratory and the Industrial Support Center electric shop, Boston.