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Machine Learning Based Anomaly Detection in Hydraulic Units of Governors in Hydroelectric Power Plants

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Abstract : Hydroelectric power plants (HEPPs) are renewable energy power plants with the highest installed power in the world. While the control systems operating in these power plants ensure that the system operates at the desired operating point, it is also responsible for stopping the relevant unit safely in case of any malfunction. While these control systems are expected not to miss signals that require stopping, on the other hand, it is desired not to cause unnecessary stops. In traditional control systems including modern systems with SCADA infrastructure, alarm conditions to create warnings or trip conditions to put relevant unit out of service automatically are usually generated with predefined limits regardless of different operating conditions. This approach results in alarm/trip conditions to be less likely to detect minimal changes which may result in serious malfunction scenarios in near future. With the methods proposed in this research, routine behavior of the oil circulation of hydraulic governor of a HEPP will be modeled with machine learning methods using historical data obtained from SCADA system. Using the created model and recently gathered data from control system, oil pressure of hydraulic accumulators will be estimated. Comparison of this estimation with the measurements made and recorded instantly by the SCADA system will help to foresee failure before becoming worse and determine remaining useful life. By using model outputs, maintenance works will be made more planned, so that undesired stops are prevented, and in case of any malfunction, the system will be stopped or several alarms are triggered before the problem grows.

Keywords : hydroelectric, governor, anomaly detection, machine learning, regression
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