Fault detection and friction monitoring in hydropower turbines

L-J. Sandström[1]*, K. Berglund[1], P. Marklund[1]

[1]Luleå University of Technology, 971 87 Luleå, Sweden

Hydropower is one of the largest renewable energy sources. As other intermittent energy sources expand, the ability of hydropower to regulate and control power output will become more critical in the future. To date, it is not known how the change in operating conditions, such as more start and stop sequences, will affect the service life of the turbines. Thus, more research regarding early fault detection and condition monitoring is needed.

Here process data from two identical Kaplan turbines are used to analyze variables connected to the runner blades. One of the turbines has suffered from a breakdown that may come from changes in friction that the operators did not notice. All variables, including the friction-dependent, are analyzed to identify what led to the consequent turbine failure. The analysis tries to answer how acceptable friction and wear behavior look and what it looked like just before the breakdown in one of the turbines. Parts of the process data show behavior like stick-slip.

Based on the analysis, it is possible to set up a model that catches anomalies in the behavior. The model allows for early detection of the problem in the future and makes it possible to create targeted maintenance efforts in time.

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*Corresponding author: lars-johan.sandstrom@ltu.se