HydroCen
NORWEGIAN RESEARCH CENTRE FOR HYDRO POWER TECHNOLOGY

FME FORSKNINGS-SENTER FOR MILJØVENNLIG ENERGI
Norges forskningsråd

GenericLife – Generic life time estimator for Francis turbine runner

Host	HydroCen, NTNU
Project Manager	Ole Gunnar Dahlhaug
Project Period	2020
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Research Partners	NTNU, EDR Medeso

Background:
The current average age of the hydro power turbines in the Norwegian power system is in the order of 40 years. This leads the power plant owners to search for the optimal time to refurbish, in order to avoid retiring turbines prematurely, while ensuring no catastrophic failures linked to turbine end of life.

Much research have been put into understanding the physical phenomena that cause the wear on hydro power turbines, and potential mitigation techniques. While this fundamental research on the physics is of high importance, the implementation of the results is far into the future.

To bridge this gap, it is suggested to develop a generic lifetime estimator. This could be implemented for all turbines in the fleet, and will mitigate the current lack of a consistent estimate of remaining lifetime. It should also be able to incorporate any additional knowledge held by the owner/designer/operator, as different plants have different characteristics.

Main goal:
Develop generic lifetime estimator with base line functionality across all Francis turbines in the fleet.

Secondary goals:
I. Develop a generic lifetime estimator able to incorporate external data from commercial models and relevant results from new research.
II. Use engineering knowhow, available runner data and known physics to establish a simplified generic wear model.
III. Use Bayesian statistics to estimate remaining lifetime based on known and unknown operation, and asses uncertainty in the results.

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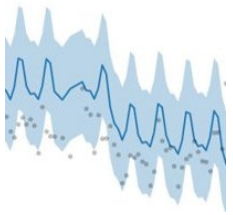
Lifetime estimates can have an enormous value for power plant owners. This can be used in the planning of maintenance and refurbishment; today, this is usually calendar-based, and not something that updates based on actual operation. Another use of lifetime estimates is in cost-setting of different operational schemes.

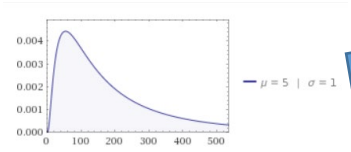
The hydropower industry lack a set of simple, generic damage modules that can be deployed on a broad selection of power plants. Such modules needs to be developed and coupled with a statistical lifetime estimator. The interface between the modules have to be generic and open such that they are interchangeable and modular.

EDRMedeso work on developing generic lifetime estimators based on Bayesian interference, where the probability of an event is continuously updated based on actual operation. In addition, Monte Carlo simulations is implemented to handle uncertainty. It is proposed that the generic damage modules created are coupled with these lifetime estimators.

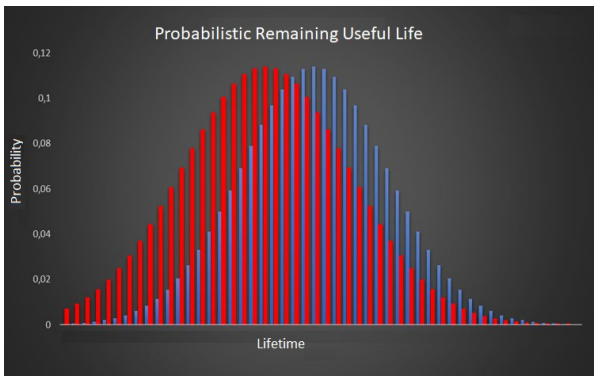
The project will be a collaboration between the Waterpower Laboratory, EDRMedeso and Statkraft, and has a goal of proving the above outlined concept.



Operation



Uncertainty



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