Distributional considerations in inference based condition monitoring stages: detection, diagnosis and prognosis.

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ABSTRACT

The major focus of condition monitoring (CM) is in its' prognostic and fault prediction abilities, the power of which is determined by selecting the appropriate statistical techniques. Making the correct distributional and theoretical assumptions is the key to model robustness and strength of inference. Likewise a condition based rather than time interval based maintenance regime ensures near optimal performance for the duration of process operation, the ever increasing drive for environmental supremacy and the highest safety standards alongside increasing global competition forces companies to strive for the greatest possible achievements in both performance and quality.

Decisions are made daily about manufacturing processes in the presence of variability, process specific knowledge allows quantification of the risks associated with various courses of action while statistics provides a common language to communicate information. A process is considered to be in a state of statistical control if any variations in observed measurements can be attributed to chance variation only not assignable variability which it is feasible to detect and identify (loose belt, leaky valve etc). Thus a process under statistical control operating under the influence of common causes of variation only should be operating within the upper and lower control limits. Optimising process performance in all aspects it is essential that deviations from the norm and or mechanical faults are detected, quantified and corrected in a timely manner.
Condition monitoring provides a non-intrusive method of extracting data which has zero impact on the operation, (for example the analysis of signal data of reciprocating compressors) via appropriately inserted sensors, is ideal and gleans relevant information as to the state of the process under observation, enabling assessment of the current condition of the system, prediction of failures and/or remaining operating time. Through suitably established statistical models condition predictors and reliability prognosis in systems is possible and of vital importance in maximising all aspects of efficiency.