

# Exergy Based Multi-State Reliability Model for a Stationary Gas Turbine

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## Abstract

This paper presents a multi-state reliability model for stationary gas turbines. The states are defined by mapping the actual operation data to a normalized exergy space. The state transition intensities are determined idealizing the actual operation data as discrete state continuous time process. The Chapman Kolomogrov equation for a general multi-state model together with the solution method is successfully formulated. The proposed methodology can be applied to any gas turbine or turbomachinery, with the only requirement that the operation data for a sufficiently long period is available. In the present paper, it is applied to two identical single-shaft gas turbines. As it turned out, it was possible to develop three state reliability models for each turbine and predict forced outage rates. The results are applicable for short-term planning of the operation of gas turbines and their maintenance schedules.

## Keywords

Multi-State Reliability, Gas Turbine, Exergy, Markov Chain, Short-Term Reliability