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PII: S0951-8320(17)30443-X
DOI: 10.1016/j.ress.2017.04.013
Reference: RESS 5809

To appear in: *Reliability Engineering and System Safety*

Please cite this article as: Demet Özgür-Ünlüakın, Taner Bilgiç, Performance Analysis of an Aggregation and Disaggregation Solution Procedure to Obtain a Maintenance Plan for a Partially Observable Multi-Component System, *Reliability Engineering and System Safety* (2017), doi: 10.1016/j.ress.2017.04.013

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Abstract

We analyze the performance of an aggregation and disaggregation procedure in giving the optimal maintenance decisions for a multi-component system under partial observations in a finite horizon. The components deteriorate in time and their states are hidden to the decision maker. Nevertheless, it is possible to observe signals about the system status and to replace components in each period. The aim is to find a cost effective replacement plan for the components in a given time horizon. The problem is formulated as a partially observable Markov decision process (POMDP). We aggregate states and actions in order to reduce the problem space and obtain an optimal aggregate policy which we disaggregate by simulating it using dynamic Bayesian networks (DBN). The procedure is statistically compared to an approximate POMDP solver that uses the full state space information. Cases where aggregation performs relatively better are isolated and it is shown that k-out-of-n systems belong to this class.

Keywords: Maintenance, partially observable Markov decision processes, dynamic Bayesian networks, aggregation, disaggregation, multi-component systems

This paper has been selected for the special section of Reliability Engineering and System Safety (Elsevier) on "Applications of Probabilistic Graphical Models in Dependability, Diagnosis and Prognosis". Guest editors: Philippe Weber and Luigi Portinale.

1 Introduction

As technology evolves, maintenance planning of complex systems becomes more challenging. Unexpected downtimes of such systems are not tolerable as they may result in significant consequences

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