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EINDHOVEN UNIVERSITY OF TECHNOLOGY

Maintenance Planning under Uncertainty

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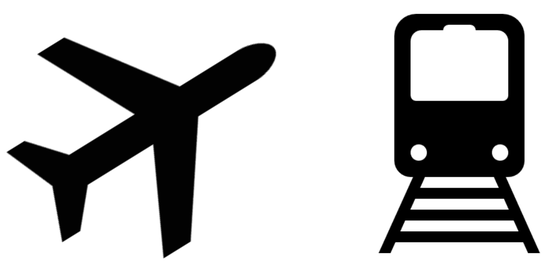
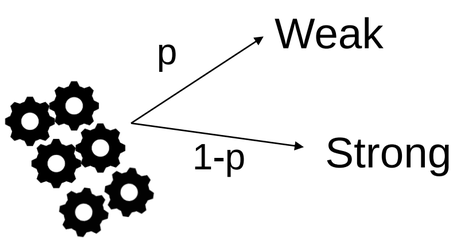
ITEA 3

PROBLEM



A system with a fixed life span

- One critical component with 2 types which breaks down randomly



Uncertainty in component type

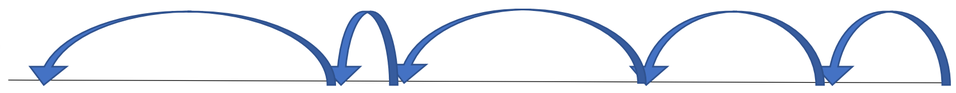
Two possible events:

Corrective Maintenance upon failure

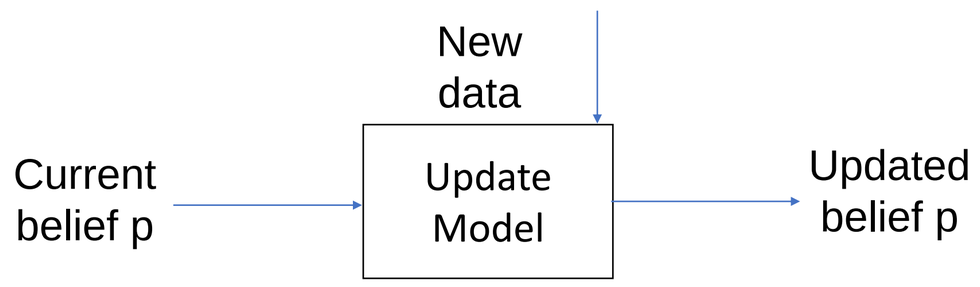
Preventive Maintenance

MODEL

Multi-cycle/forward looking approach



Bayesian Updating

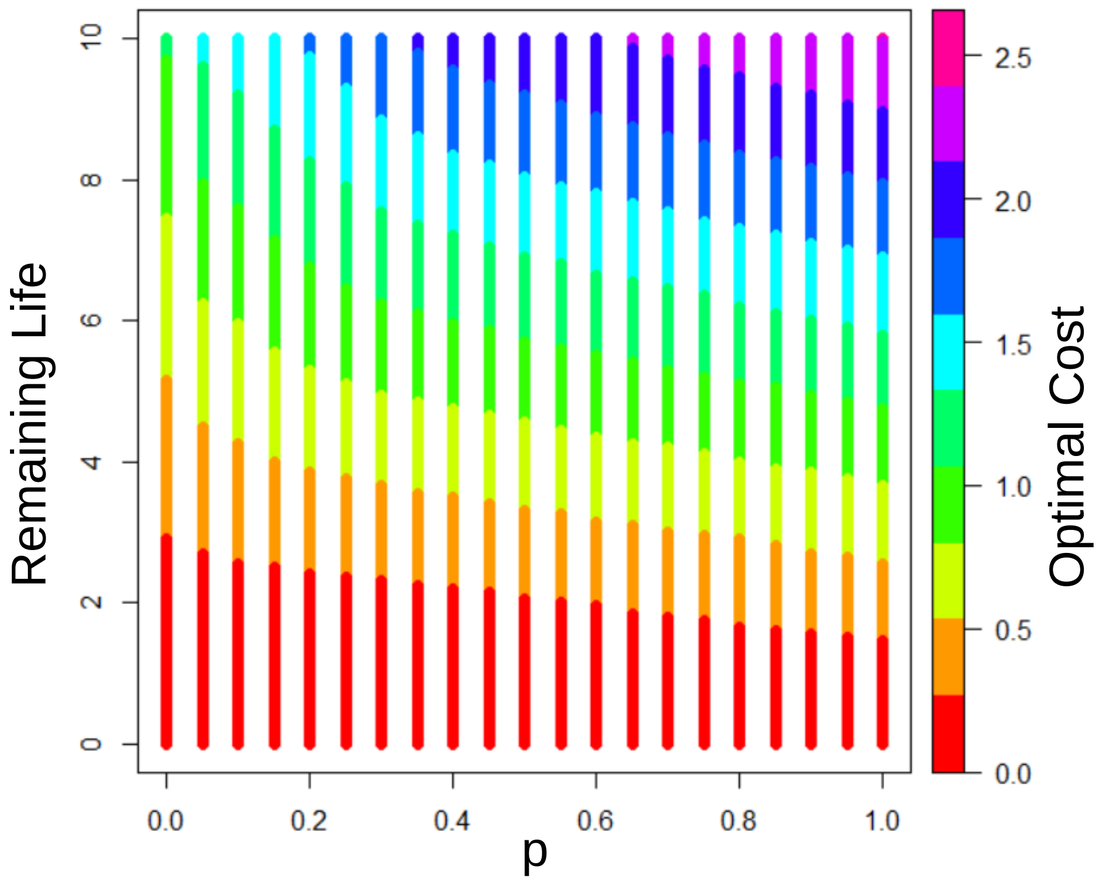


Partially observable Markov decision process model

FORMULATION

$$\text{Total Expected Cost} = \min_{0<\tau<\text{RemainingLife}} \left\{ \begin{array}{c} \text{Immediate expected cost} \\ + \\ \text{Future corrective maintenance cost} \\ + \\ \text{Future preventive maintenance cost} \end{array} \right.$$

INITIAL RESULTS AND INSIGHTS



Change of Optimal Action in Cost Functions

Decision variable τ

Immediate expected cost

Corrective maintenance cost

Preventive maintenance cost

*Figure is for Weibull distribution with shape parameter 5, scale parameters 1 and 2 for weak and strong components. Cost of preventive maintenance is 0.1 times of cost of corrective maintenance.

References

De Jonge, B., Dijkstra, A. S., and Romeijnders, W. (2015). Cost benefits of postponing time-based maintenance under lifetime distribution uncertainty. *Reliability Engineering and System Safety*, 140:15–21.

Bertsekas, D. P. (1995). *Dynamic programming and optimal control*, volume 2. Athena scientific Belmont, MA, 2 edition.

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