Infrastructure Maintenance and Inspection Scheduling with a Time-variant Transition Probability Under a State Observation Uncertainty

김종우, 최고봉, 이종민†
서울대학교
(jongmin@snu.ac.kr†)

For the safe and cost-effective operation of an infrastructure system, a scientific model based management is required. This work suggests optimization and data processing scheme for a management problem which yields an optimal operation plan. A Markov Decision Process framework is incorporated to solve the sequential optimization problem. In the infrastructure system, however, the exact measurement of the state is nearly impossible due to the intrinsic imperfection for the non-destructive inspection method. Partially Observable MDP scheme is then suggested in this work to overcome the subotimality caused by the uncertainty. In the actual implementation, an approximate point-based POMDP solver is used to overcome a large computational time for the exact solution. Water distribution system is analyzed as an illustrative example. The combination of maintenance actions with inspection actions are considered as action candidate. A structural deterioration rate over a pipe age can be modeled with a two-parameter Weibull probability distribution. Results show that the suggested POMDP framework for the infrastructure management successfully fulfilled the overall objective.