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Risk-based optimization of pipe inspections in large underground networks with imprecise information

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Abstract

In this paper, we present a novel risk-based methodology for optimizing the inspections of large underground infrastructure networks in the presence of incomplete information about the network features and parameters. The methodology employs Multi Attribute Value Theory to assess the risk of each pipe in the network, whereafter the optimal inspection campaign is built with Portfolio Decision Analysis (PDA). Specifically, Robust Portfolio Modeling (RPM) is employed to identify Pareto-optimal portfolios of pipe inspections. The proposed methodology is illustrated by reporting a real case study on the large-scale maintenance optimization of the sewerage network in Espoo, Finland.

1 Introduction

Large infrastructure networks, such as gas or water pipelines, are subjected to preventive renovation and condition inspection programmes which account for a significant portion of the network operating costs ([47], [48]). The optimization of inspections is therefore fundamental for the efficient management and competitiveness of these complex networks. Information about the current condition of the network items is needed for developing the optimal renovation programme;