UWM RESEARCH FOUNDATION

Technology Overview

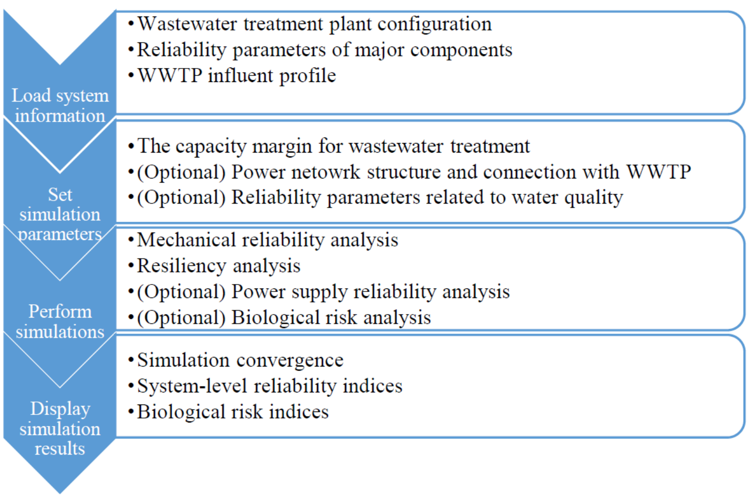
Software for Drinking Water & Wastewater System Reliability: Evaluation, Optimization, and Effluent Quality Risk

OTT ID #1491/1531

Municipal water/wastewater systems are critical infrastructures in our modern society. The reliable, secure and economical treatment and distribution of water is essential to supporting human life and national economic growth. Many cities are currently faced with deteriorating water distribution infrastructures which regularly cause water main breaks and service interruptions as well as the failing wastewater treatment facilities which may lead to effluent quality risk. The reliability of water/wastewater systems is critically important, as the loss of water supply or the discharge of untreated wastewater will bring serious health, economic, environmental, and legal consequences.

Improving the existing water/wastewater infrastructure is high on the agenda as stakeholders look to build more reliable and more efficient water/wastewater systems. Our holistic reliability analysis of these systems considers a comprehensive set of probable or contingency scenarios.

TECHNOLOGY



Our software and proprietary algorithms aim to develop comprehensive decision support tools for evaluating the reliability of municipal water/wastewater systems, enabling cost-effective preventative measures *before* system failures.

With our solution, water system planners and operators can make informed decisions on resource allocation for reinforcing the water infrastructure; and asset management strategy can be optimized to enable effective water/wastewater utility infrastructure management despite ever evolving water sector uncertainties.

FEATURES/BENEFITS

- System reliability analysis and comprehensive decision support tool
- Implement cost-effective preventative measures before system failure
- Informed decisions on resource allocation (e.g., budget allocation and staffing projection)
- Optimized asset management strategy for water/wastewater systems

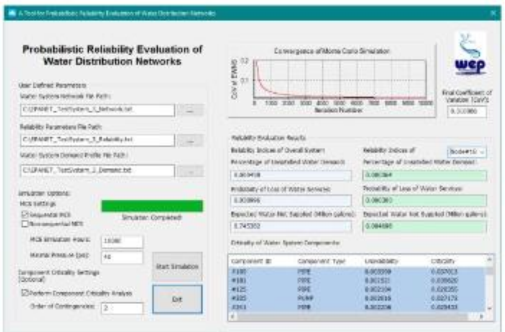
APPLICATIONS – PRESENT & FUTURE

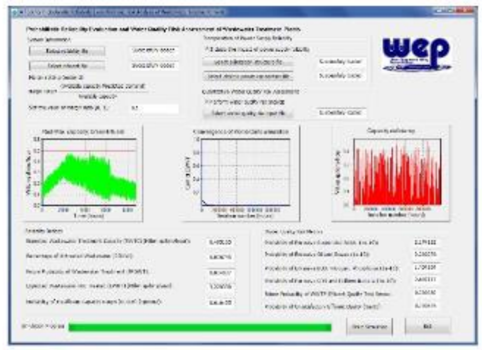
- Drinking water distribution systems of various scales
- Water & wastewater treatment plants of various scales

Technology Overview

INTELLECTUAL PROPERTY

Copyrighted Software. See screen shots below for current user interfaces.





MARKET

The software is intended to add value to water utilities through cost savings, including preventive maintenance and guiding resource allocation. Assuming preventive maintenance costs are less than catastrophic damage repair costs, the total opportunity based on the annual repair cost of broken water mains is approximately $3 billion.

The U.S. Environmental Protection Agency recently began collecting information for its second Drinking Water Infrastructure Needs Survey [and] found that **municipalities expected to spend some $77.2 billion over the next 20 years** to satisfy that need. In a similar survey conducted on the wastewater side of the industry, the Clean Water Needs Survey found that **over the next 20 years cities need to spend $10 billion on upgrading existing wastewater collection systems**, nearly $22 billion for new sewer construction and $45 billion for controlling combined sewer overflows. Another $7 billion is needed to control municipal storm water.

AUTHOR

Dr. Lingfeng Wang is an Associate Professor in the Department of Electrical Engineering and Computer Science at the University of Wisconsin-Milwaukee, where he directs the Trustworthy Cyber-Physical Systems and Infrastructures Laboratory. Dr. Wang's research is focused on the quantitative risk assessment for national critical infrastructures from the perspectives of system reliability, resiliency and cybersecurity, including electrical energy systems, drinking water distribution systems, wastewater reclamation facilities, natural gas distribution networks, smart cities, etc. His research team is also working to build comprehensive, stochastic models for capturing the interdependencies among critical infrastructures (e.g., water-energy nexus) in order to improve their resiliency in the presence of natural or man-made disasters. He is the author or co-author of more than 300 technical publications in these research fields.

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