

An Integrated Simulation Model for Water Purification and Distribution

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Abstract

As systems become more connected, their complexity arises likewise. It is true that often in looking at a process by decomposing it in subsystems there are some information that go lost. Process components interact with each other in direct and indirect ways and the more the model is precise, the more the view on its functioning is clear. It could be affirmed that the whole carries more information than the sum of its parts.

In this context, there is the need to develop integrated models to better evaluate critical system's properties as safety and reliability could be. This work presents the development of a simulation model that aims to evaluate the impact on society a water purification plant failures may have. To do so, the purification plant is digitalised in the MATLAB/Simulink virtual environment by modeling each of its component through Simscape physical blocks libraries. Moreover, a wider view is provided by the modelling of a water distribution network through EPANET, a hydraulic-simulation specific software. The two models are finally connected one to another with the implementation of a MATLAB custom script that makes use of an open-source toolkit to reproduce the real-world integrated system. Simulations are made by taking into account system's safety issues as water shortage or contaminated water distribution, but the presented model can easily be adapted to evaluate different system properties.

Keywords

Simulation model, Critical infrastructures, Water purification plant, Water distribution network, Systems theory

Biography

Francesco Simone is a recently graduated student in Mechanical Engineering specialized in Industrial Production at Sapienza University of Rome. Currently, after winning a research grant from Sapienza University of Rome, he is working as contract researcher at the Department of Mechanical and Aerospace Engineering. During his career, Francesco managed to deepen his knowledge on production engineering themes as: innovative manufacturing technologies such as LASER and Additive Manufacturing; Lean Manufacturing and Lean Thinking techniques; Operation and Project management fundamentals; safety and maintenance of plants and systems. He developed a particular interest on systems theory and its application on complex systems' resilience after his research work for Master Thesis in which he investigated societal impact cyber-attacks could have if successfully performed on CPSs. His aspiration is to give a valuable research contribution and continue his studies obtaining a PhD.