## Functional Data Analytics for Detecting Bursts in Water Distribution Systems

ABSTRACT - Bursts in water distribution systems (WDSs) are a special type of short-term, high-flow water loss that can be a significant component of a system's water balance. Since WDSs are usually deployed underground, bursts are difficult to be detected before their catastrophic results are observed on the ground surface. Continuous hydraulic data streams collected from automatic meter reading and advanced metering infrastructure systems make it possible to detect bursts in WDS based on data analytics. Existing methods based on conventional statistical process control charts may not be effective, as the temporal correlations imbedded in the data streams are not explicitly considered. In this seminar, new control charts for burst detection based on functional data analysis will be presented. Both Phase-I and Phase-II monitoring schemes are investigated. The temporal correlations are modeled from empirical data streams continuously collected from the same WDS. Their statistical properties are studied to reflect system inherent uncertainties induced by customers' daily use without bursts. The bursts are detected by comparing the new hydraulic data stream to the inherent uncertainties through statistical control charting. The new method will significantly reduce the rate of false alarm and miss detection. The effectiveness of the proposed method is demonstrated with a case study based on numerical simulation of a real-world WDS.
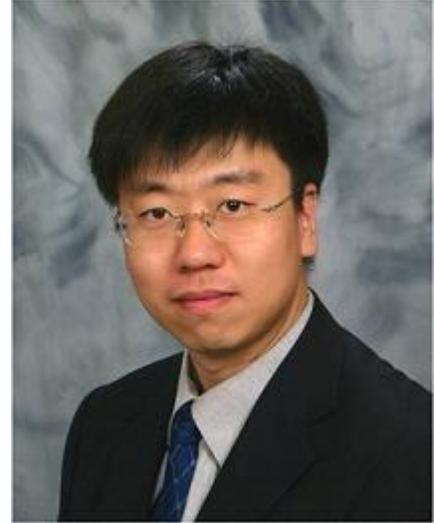
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SPEAKER BIO - Dr. Jian Liu is an Associate Professor in the Department of Systems & Industrial Engineering at The University of Arizona. Dr. Liu's research specialty is in the fusion of multi-source, multi-scale and multilevel information in hierarchical and distributed systems for better system design, operation and maintenance. He serves as an Associate Editor of the Journal of Manufacturing Systems since 2017. He is a member of INFORMS and a member of IISE. He served as a Council Member of Quality, Statistics and Reliability Section of INFORMS from 2012 to 2014, a Board Director of the Quality Control and Reliability Engineering (QCRE) Division of IISE from 2013 to 2015, and the President of QCRE from 2016 to 2017. His research has been supported by NSF, AFOSR, among others.

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