

Date: Monday, June 11th, 2018 – Time: 16:00-17:00

**Place: 314 Room 3rd Floor, Building S7-5, Environment and Information Sciences 1,
(環境情報 1 号棟), Yokohama National University**

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Life-Cycle, Risk, Resilience and Sustainability of Infrastructure

Dan M. Frangopol

<http://www.lehigh.edu/~dmf206>

Abstract: Our knowledge to model, analyze, design, maintain, monitor, manage, predict and optimize the life-cycle performance of structures and infrastructure under uncertainty is continually growing. However, in many countries, including the United States, the civil infrastructure is no longer within desired levels of performance. Decisions regarding infrastructure systems should be supported by an integrated risk-, resilience- and sustainability-based life-cycle multi-objective optimization framework by considering, among other factors, the likelihood of successful performance and the total expected cost accrued over the entire life-cycle. The primary objective of this lecture is to present a framework for risk-, resilience- and sustainability-informed decision making for structural systems and networks in a life-cycle multi-objective optimization context. Risk-based performance metrics allow engineers to combine the probability of structural failure with the consequences corresponding to this event. The sustainability performance metric is established considering the risks associated with economic, social, and environmental impacts, utility theory, and the decision maker's risk attitude. Applications include time-variant reliability, risk, resilience, and sustainability of bridges, bridge transportation networks, and interdependent infrastructure systems under multi-hazards.

Keywords: risk; resilience; sustainability; multi-hazards; cost; monitoring; life-cycle management; optimization; decision making



Dr. Dan Frangopol is the inaugural holder of the Fazlur R. Khan Endowed Chair of Structural Engineering and Architecture at Lehigh University. Before joining Lehigh University in 2006, he was Prof. of Civil Engineering at the University of Colorado at Boulder, where he is now Prof. Emeritus. He is recognized as a leader in the field of life-cycle engineering of civil and marine structures. His main research interests are in the application of probabilistic concepts and methods to civil and marine engineering including structural reliability, probability-based design and optimization of buildings, bridges and naval ships, structural health monitoring, life-cycle performance maintenance, management and cost of structures and infrastructures under uncertainty, risk-based assessment and decision-making, infrastructure sustainability and resilience to disasters, and stochastic mechanics. He is the Founding President of the International

Associations for Bridge Maintenance and Safety (IABMAS) and Life-Cycle Civil Engineering (IALCCE). He has authored/co-authored over 370 articles in archival journals including 9 award-winning papers. He is the Founding Editor of *Structure and Infrastructure Engineering*. Dr. Frangopol is the recipient of several medals, awards, and prizes, from ASCE, IABSE, IASSAR, and other professional organizations, such as the OPAL Award, the Newmark Medal, the Alfredo Ang Award, the T.Y. Lin Medal, the F. R. Khan Medal, and the Croes Medal (twice), to name a few. He holds 4 honorary doctorates and 12 honorary professorships from major universities. He is a foreign member of the Academia Europaea (Academy of Europe, London) and the Royal Academy of Belgium, an Honorary Member of the Romanian Academy, and a Distinguished Member of ASCE.