# IEEE CIS Seminar

**Prof. Patrick Reed**
**Cornell University, Ithaca NY, USA**

**Venue: LT5 (B30, LT South), UNSW Canberra**
**Time: 2:30-3:30pm, 20 February 2018**

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## Discovering Tradeoffs, Vulnerabilities, and Stakeholder Dependencies in a Changing World

Over the past decade my research group has worked to operationalize our "*many-objective visual analytics*" (MOVA) framework for the design and management of complex engineered systems. The MOVA framework has four core components: (1) elicited problem conception and formulation, (2) massively parallel many-objective search, (3) interactive visual analytics, and (4) negotiated design selection. Problem conception and formulation is the process of abstracting a practical design problem into a mathematical representation. We build on the emerging work in visual analytics to exploit interactive visualization of both the design space and the objective space in multiple heterogeneous linked views that permit exploration and discovery. Negotiated design selection uses interactive visualization, reformulation, and optimization to discover desirable designs for implementation. Each of the activities in the framework is subject to feedback, both within the activity itself and from the other activities in the framework. These feedback processes transition formerly marginalized "constructive learning" activities of reformulating the problem, refining the conceptual model of the problem, and refining the optimization, to represent the most critical process for innovating real world systems (i.e., learning how to frame the problems themselves). My presentation will use our recent successful applications in urban water portfolio planning and satellite constellation design to demonstrate the key computational innovations in our MOVA framework.

Dr. Patrick M. Reed Cornell University as a Full Professor of Civil and Environmental Engineering in 2013. Dr. Reed's primary research interests relate to using multiobjective evolutionary algorithms to support the design and management of complex engineered systems, with a particular focus on the global water-energy-food nexus. The tools developed in Dr. Reed's group bridge sustainability science, risk management, economics, multiobjective decision making, operations research, computer science, and high performance computing.

Recently, Dr. Reed has been honored as the iEMS Biennial Medalist for Exceptional Research Contributions to Environmental Modeling and Software and the ASCE Walter L. Huber Civil Engineering Research Prize. Engineering design and decision support software developed by Dr. Reed has been used broadly in governmental and industrial application areas. His open source and free academic software related to multiobjective optimization has tens of thousands of users across the world.