

# Factorial Multi-Stage Stochastic Programming Methods for Water Resources Management

Clean, safe, secure and available water is essential to the sustainable prosperity of world and Canada. Growing water scarcity and rising water demand are posing challenges in terms of rational and efficient management of water resources. An effective way of addressing such challenges is to manage water resources from the perspective of system. Uncertainty, an inevitable concomitant of unknown events and/or imprecise information, exists in many system components, influences decision process, and may thus intensify the complexities of water resources management. Mr. Zhou's research efforts mainly focus on coping with the complexities and uncertainties in water resources management as well as developing sound optimization methodologies for water resources management.

## Primary Research Contributions

- **Development of a factorial two-stage stochastic programming (FTSP) approach for water resources management.** This work was an original attempt to integrate factorial analysis with inexact optimization techniques. It filled the gap that conventional inexact optimization methods merely provide guidelines of decisions but do not provide in-depth decision analysis and support for decision makers. By considering the interrelationships of uncertain parameters, the FTSP approach could better reveal the essence of the study system, assist decision makers to realize the effects of parameters and their interactions on system performance, and eventually gain more reliable and solid decision support.

- **Development of a factorial multi-stage stochastic programming (FMSP) approach for water resources management.** This work improved previous FTSP approach by considering multi-period situations. The FMSP approach could effectively reflect dynamic variations of multiple system components or conditions; meanwhile, it could provide systematic and comprehensive decision support for decision makers. Furthermore, the analytical and computational efficiencies were improved in FMSP approach. This approach has better applicability and practicability in water resources management under uncertainty.

## Other Research Interests

- Regional Climate Modelling
- Statistical Downscaling
- Geographic Information System

