

#### PROFESSIONAL AFFILIATIONS

- Fellow and Honorary Member, ASCE
- Fellow, AGU
- Member, AWRA
- Member, IWRA
- Associate Editor, Water Resources Research, AGU, 1984-1988
- Associate Editor, Journal of Water Resources Planning and Management, ASCE, 1984-1988
- Editor, Journal of Water Resources Planning and Management, ASCE, 1988-1993

#### COMMITTEE MEMBERSHIP - SERVICE

- Control Member, ASCE Task Committee on Calibration and Verification in Ground Water Modeling, 1976-1979
- Member, ASCE Task Committee on Reservoir Systems Regulations, 1978-1980
- Control Member, ASCE National Committee on Water Resources Systems, 1982-86
- Vice Chairman and Control Member, ASCE National Committee of ASCE on Water Resources Systems, 1983-1984
- Chairman and Control Member, ASCE National Committee on Water Resources Systems, 1984-1985
- Control Member, ASCE Publications Committee, Water Resources Planning and Management Division, 1984-1993
- Chairman, ASCE Publications Committee, Water Resources Planning and Management Division, 1988-1993
- Control Member, ASCE Awards Committee, Water Resources Planning and Management Division, 1988-1996
- Control Member, ASCE Task Committee on Computational Issues in Optimal Aquifer Remediation, 1994-1997
- Vice Chair and Control Member, ASCE Ground Water Management Committee, 1997-1999
- Control Member, ASCE Task Committee on Effective Parameters in Ground Water Management, 1997-2000
- Chair and Control Member, ASCE Ground Water Management Committee, 1999-2000
- Secretary, ASCE/EWRI Standards Committee on "Standard Guideline for Fitting Saturated Hydraulic Conductivity Using probability Density Functions," 2005- Present.
- Member, AGU Water Resource Environmental Management Committee, Hydrology Section, 1980-82
- Member, AGU *Water Resources Research*, Editor Search Committee, 1986-1987
- Member, AGU Horton Award Committee, 1992-1995
- Chairman, AGU Horton Award Committee, 1994-1995
- Member, AGU Executive Committee, Hydrology Section, 1992-1995; 1998-2000
- Chairman, AGU Horton Award Committee, 1998-2000
- Member, AGU Hydrology Section Fellows Committee, 2000-2002
- Member, AGU Honors and Recognitions Committee, 2000-2004

# OPTIMIZATION OF HYDRO-SYSTEM MANAGEMENT AND OPERATION

## HYDROLOGY DAYS AWARD LECTURE

COLORADO STATE UNIVERSITY

MARCH 25, 2014

## WILLIAM W-G YEH

Richard G. Newman AECOM Distinguished Professor of Civil Engineering  
Department of Civil and Environmental Engineering  
University of California, Los Angeles

In recognition of outstanding contributions to hydrologic science and engineering in the areas of groundwater modeling, planning of conjunctive use of surface water and groundwater, and the development of methodologies and models for optimizing large-scale water resources systems



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## OPTIMIZATION OF HYDRO-SYSTEM MANAGEMENT AND OPERATION

WILLIAM W-G YEH

Richard G. Newman AECOM Distinguished Professor of Civil Engineering  
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**Abstract.** With the drastic advancement made in computing power as well as the availability of solvers during the last two decades, optimization models have been successfully developed and applied to the management and operation of highly complex reservoir and water distribution systems. This paper reviews the historical development of mathematical models for hydro-system management and operation over the last four decades. Analyzing a complex water resources system may involve tens of thousands of decision variables and constraints. Once the objective function and constraints have been quantified, most problems lend themselves to solution techniques developed in the field of operations research and management science. This paper will survey the available linear and nonlinear solvers. Additionally, the paper will review several case studies where optimization models have been successfully applied. The case studies reviewed include the water distribution system of the Metropolitan Water District of Southern California (MWD), the Brazilian hydropower system and the Three Gorges Project in China. The MWD system delivers water to 18 million people in Southern California, USA. The Brazilian hydropower system has an installed capacity of 70,000 MW and supplies over 90% of the energy consumed in Brazil. The Three Gorges project has an installed capacity of 22,500 MW. A small improvement in operation of a system of such size translates into enormous benefits.

### EDUCATION

- B.S., National Chen-Kung University, Taiwan, 1961
- M.S., New Mexico State University, 1964
- Ph.D., Stanford University, 1967

### POSITIONS HELD

- Distinguished Professor and Chair, UCLA, 2002 - 2007
- Distinguished Professor and Vice Chair, UCLA, 1998 - 2002
- Distinguished Professor, Above-Scale, UCLA, 1996 - present
- Professor and Chair, UCLA, 1985 - 1988
- Professor and Vice Chair, UCLA, 1979 - 1982
- Professor, UCLA, 1977 - 1996
- Associate Professor and Vice Chair, UCLA, 1975 - 1976
- Associate Professor, UCLA, 1973 - 1977
- Assistant Professor, UCLA, 1969 - 1973
- Assistant Research Engineer, UCLA, 1967 - 1969

### RECOGNITION AND AWARDS

- Distinguished Faculty Award for Excellence in Teaching, UCLA Engineering Alumni Association, 1975
- Engineering Foundation Fellowship Award, 1981
- Robert E. Horton Award, American Geophysical Union, 1989
- Elected Fellow, American Geophysical Union, 1993
- Outstanding Journal Paper Award, Water Resources Planning and Management Division, ASCE, 1994
- Julian Hinds Award, American Society of Civil Engineers, 1994
- Elected Fellow, American Society of Civil Engineers, 1994
- Elected Honorary Member, American Society of Civil Engineers, 1996
- Centennial Distinguished Alum, New Mexico State University, 1996
- Warren A. Hall Medal, Universities Council on Water Resources, 1999
- Outstanding Alumni Award, National Cheng Kung University North American Alumni Foundation, 2003
- Elected Member, National Academy of Engineering, 2008
- Distinguished Alumnus Award, National Cheng Kung University, Taiwan, 2008
- Elected Honorary Diplomate, American Academy of Water Resources Engineers, 2008
- Appointed Inaugural Richard G. Newman AECOM Endowed Chair in Civil Engineering, 2010
- Elected AAAS Fellow, American Association for the Advancement of Science, 2011
- Received a Lifetime Achievement Award, EWRI/ASCE, 2012

### AUTHORSHIP

- Author and co-author of more than 127 publications in refereed journals.
- Author of 1 textbook
- Author of 7 book chapters