

Optimization of Hydrosystem Management and Operation

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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 hydrosystem 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.