

## Water Supply Network Optimization: State of the Art.

**Gabriel Paschoalotti Negri (IC), Bruno Melo Brentan (PG), Edevar Luvizotto Junior (PQ).**

### Abstract

The optimization of water supply network shows efficient in reducing deployment costs of pipes; ease of project design and in its future management. Currently, the main challenge in the design is to find solutions that ensure capacity to the system to work with quality in all your demands, even if there are any local deficiencies (cracks in pipes, for example). Having this new paradigm in mind, this research sought a bibliographic database that works with this kind of method, and that confirms its operation. The Resilience Index, introduced by *Todini (2000)*, has been widely referred in the literature, and it was efficient as an indirect measure of the reliability of drinking water distribution networks.

*Key words: Water distribution network, multi-objective optimization, state of the art.*

### Introduction

The multi-objective optimization aims to provide a sizing within the criteria and pre-established limits on the project in order to minimize deployment costs while maximizing the reliability of the water supply system, that is, increase the capacity of the distribution to comply with their demands even under abnormal operating conditions. In this respect, the survey aims to bring, through a literature research, methodologies to work the concept of resilience in optimizing the design of water distribution networks and the challenges to overcome under adverse conditions.

### Results and Discussion

To carry out this work, the search for articles related to the subject was made by means of academic publications bases. Reading the summaries provided mechanism to verify that the document found was appropriate or not to the search order. With a survey of the results obtained in the articles, it was found that the use of Resilience Index multi-objective optimization implies a satisfactory measure of the reliability of water supply networks.

Since the Resilience Index (IR) introduced aspects previously not assessed, such as efficiency, adaptability and cohesion, the work done by *Todini (2000)*, puts a basis for new methods can be created thinking not only in the economy (reduced costs), but bringing also a social and environmental vision in the design of water supply networks. Thus, many current studies use the IR reference and comparison on theses, justifying the importance of the method.

In one of the studies, for example, held by Raul Baños (2011), some methods are compared by the amount of solutions that meet the needs of a network in situations of over-demand. The

optimization that used the Todini Resilience Index was the one that was more consistent in the cases studied.

### Conclusions

The multi-objective optimization of water supply networks is complex and brings many difficulties. The Resilience Index is a methodology, other criteria have yet to be included and dealt in future research, so that they can be used in real trouble, going to consider all components of a system (pumps, tanks and valves) as well as your topology.

Despite the difficulties, the multi-objective optimization is promising and may facilitate future control and maintenance of water supply networks without harming offered to customers.

### Acknowledgement

CNPq program / PIBIC the research project funding, and UNICAMP for granting the scholarship.

<sup>1</sup>TODINI, Ezio, "Looped water distribution networks design using a resilience index based heuristic approach" – Department of Earth and Geo-Environmental Sciences, Universidade de Bologna, Itália – Elsevier Science, Urban Water 115-122, Setembro 2000.

<sup>2</sup>BAÑOS, Raúl et al, "Resilience Indexes for Water Distribution Network Design: A Performance Analysis Under Demand Uncertainty" – Springer Science + Business Media B.V., 30 de março de 2011..