Advanced design, retrofit, operation and maintenance of water resources systems

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The use of the resources exploited within facilities and networks is of primary importance in a world that aims at respecting nature and that desires to limit air pollution and the waste of environmental resources. Increasing alarms over current climate change and the future of the planet is leading to a shift away from nonrenewable resources such as fossil fuels and the use of Renewable Energy Sources (RESs), thus contributing to decarbonisation. The rational use of resources represents a key point: all resource categories must be accurately managed so as to smartly conduct energy transition.

Water represents a key RES and a rational water usage is a crucial milestone to target the challenging objectives for 2030 and 2050. Water resources systems require advanced and innovative solutions to guarantee the needed performance in order to focus, assess and approach these objectives.

Water is exploited in many sectors, e.g., Water Distribution Networks (WDNs), renewable energy production, and wastewater treatment. Complex processes characterize these water resources systems and different coupling effects are present, e.g., electrical, mechanical, and hydraulic; in addition, their management can involve also market conditions and incentives.

In order to improve sustainability in water resources systems, tailored energy efficiency strategies must be adopted, e.g., enhancement of the energy performance and reduction of the water losses. Energy efficiency strategies should be included in the initial design in the case of new plants, while retrofit strategies can be adopted for existing plants. In addition, sustainability in daily management of the involved processes requires advanced operation and maintenance methods.

The present Special Session aims to collect contributions related to advanced design, retrofit, operation and maintenance of water resources systems with a focus on sustainability, in order to provide emerging technologies and best practices. Contributions on digitalization, data, modeling, and forecast are also welcome, due to their massive impact on the topic. The Special Session will take into consideration research works on field applications and simulations in virtual environments. In addition, research works on methodologies that bridge the gap between simulations and field application are encouraged, together with works on the transition from research to large-scale deployment.

Some examples of specific themes on water resources systems include, but are not limited to:

- Energy management system
- Key Performance Indicator
- Interoperable tools
- Big Data
- Artificial Intelligence
- Expert System

Proposal 3 submitted to 3rd IFAC Workshop on Integrated Assessment Modelling for Environmental Systems. Received January 10, 2024.

- Decision Support System
- Advanced Process Control
- Model Predictive Control
- Optimization
- Fault Detection/Isolation/Diagnosis
- Predictive Maintenance
- Digital Twin
- Internet of Things
- Benchmark case study
- Technology Readiness Level

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