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Special Issue Reprint

Hydrodynamics in Pressurized Pipe Systems

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This Reprint presents recent advances in the analysis, modeling, and operation of pressurized water pipeline systems, with a particular focus on hydrodynamic processes under steady and transient flow conditions. The collected contributions address key challenges associated with water hammer, pressure surges, wave propagation, fluid–structure interaction, turbulent transient flows, and hydraulic losses in complex pipe geometries. Several studies investigate the behavior of pipelines during filling and emptying operations, highlighting the importance of air–water interactions, air valve performance, and operational strategies for mitigating negative pressures and excessive pressure surges. Advanced numerical methods, including one-dimensional, quasi-two-dimensional, and three-dimensional computational models, are evaluated and validated against experimental data to improve the prediction of transient hydraulic phenomena. The Reprint also explores pressure-dependent leakage modeling for pipeline design, demonstrating the need for more realistic approaches to system sizing and performance assessment. Emerging technologies, including Digital Twin frameworks, real-time monitoring, computational fluid dynamics, and data-driven methods, are presented as powerful tools for enhancing the safety, efficiency, and reliability of water distribution infrastructure. Together, the contributions provide a comprehensive overview of current research trends and practical solutions for the design, operation, and management of pressurized pipe systems, offering valuable insights for researchers, engineers, and water utility professionals.



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