Unsteady friction computation in a hydraulic commercial software

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Abstract Up to date, transient analysis methods are mainly theoretical, and their implementation to real engineering problems is constrained due to several physical phenomena not accounted for, such as unsteady friction. This study investigated the behavior of different unsteady friction models in Python environment which are compared based on well-developed criteria to be implemented in WANDA commercial software. Vítkovský's unsteady friction model was found to be the most-suited to be implemented in WANDA. The upgraded WANDA was then tested on a simple hydraulic network. The newly implemented Vítkovský's friction model has significantly influenced the damping over the conventional quasi-steady friction.

Keywords: Transient analysis, unsteady friction, water hammer, WANDA

Introduction

I. Commercial transient analysis use steady friction for hydraulic computation
II. Unsteady friction implemented in research papers unlike commercial software
III. Need of implementation of unsteady friction in commercial hydraulic software

Methods

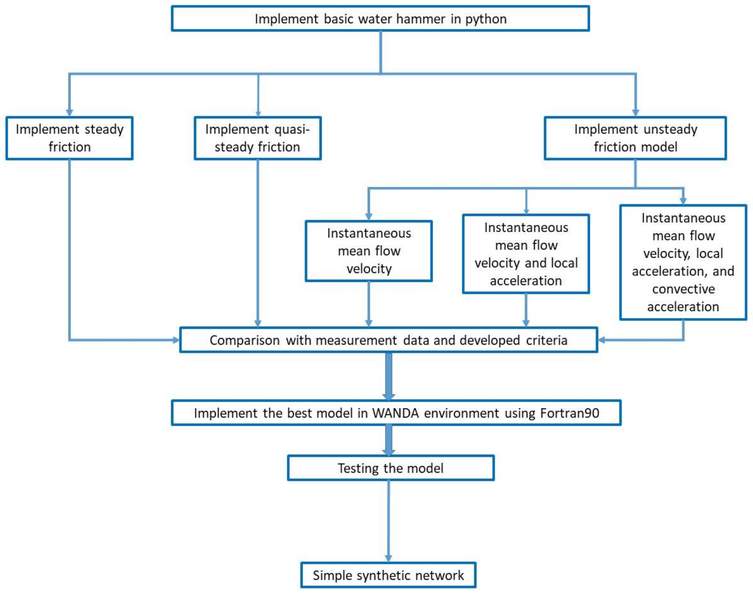

Figure 1: Schematic of the research methodology

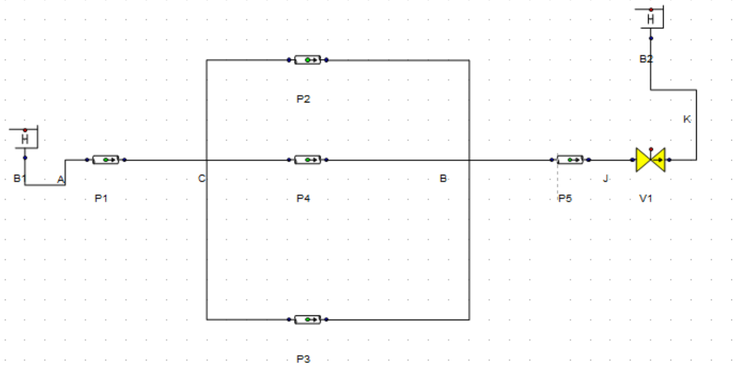

Figure 2: Simple network configuration

Developed comparison criteria

I. User input requirements for the model
II. Stability of the model
III. Computational efficiency
IV. Model accuracy

Results

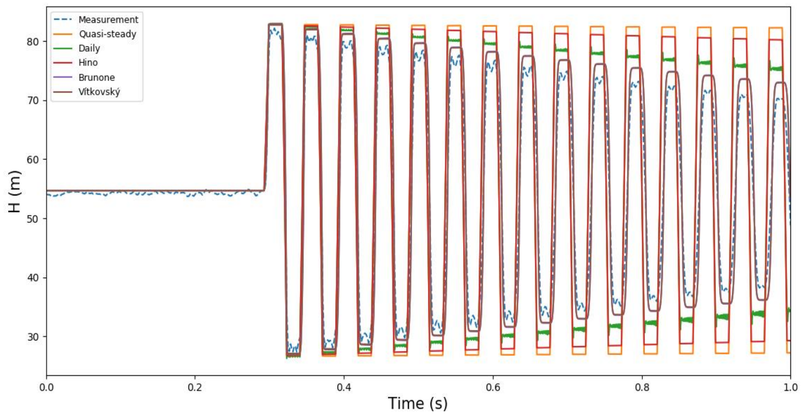

Figure 3: Implementation of different unsteady friction models

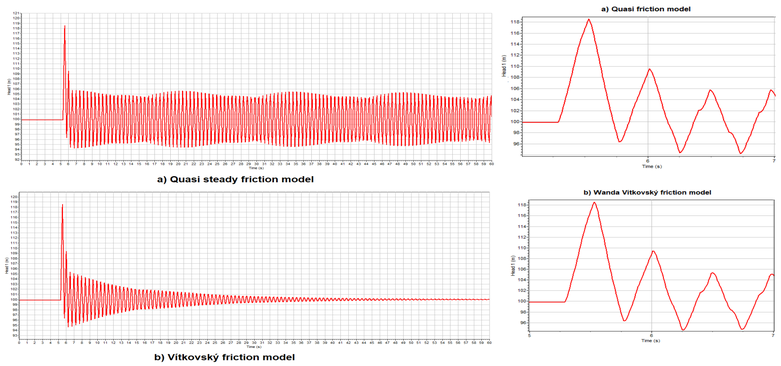

Figure 4: Simple network computation

Conclusions

- Unsteady friction is significantly important for different applications and tasks executed by standard engineers
- Vítkovský friction was found to be the best-suited unsteady friction model to be implemented in WANDA according to the developed criteria mentioned in this study
- Vítkovský's friction provided affordable computational efforts and high moderate accuracy in the context of transient analyses in hydraulic networks

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