Smoothed Particle Hydrodynamics at ANDRITZ: Long-Term Development, Industrial Applications, and Research Advances

M. Rentschler[*] and J.C. Marongiu[*]

[*]ANDRITZ Hydro Switzerland
R&D
Rue des Deux gares 6, 1800 Vevey, Switzerland
Email: martin.rentschler@andritz.com - Web page: http://www.andritz.com

ABSTRACT

This presentation highlights the long-term development and industrial application of Smoothed Particle Hydrodynamics (SPH) methods at ANDRITZ Hydro. Based on the SPH-ALE (Arbitrary Lagrangian-Eulerian) formulation, the meshless approach enables stable and accurate simulation of highly dynamic free-surface flows, particularly in scenarios involving moving boundaries and two-phase interfaces.

SPH has become a key component in the design workflow for Pelton turbines, supporting the evaluation of runner bucket performance, pressure distribution, and casing flow optimization. It is especially effective in simulating transient events such as deflector engagements and braking jets, contributing to faster design iterations and improved robustness. Applications also extend to transient simulations in Francis turbines, including start-up sequences.

Several industrial use cases will be presented, demonstrating how SPH simulations have supported design validation, performance optimization, and operational reliability in real-world hydro turbine projects. In addition, the talk will cover recent research developments aimed at improving SPH accuracy and enabling hard coupling with CFD and FEM solvers, expanding the method's applicability to more complex fluid-structure interaction problems.

REFERENCES

[1] J.C. Marongiu, F. Leboeuf, J. Caro, E. Parkinson, "Free surface flows simulations in Pelton turbines using an hybrid SPH-ALE method", J. Hydr. Research, 48 (2009).