



## **“... come la geometria è la base della scienza delle acque”: Bernardino Zandrini and the measurement of flow rate**

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Bernardino Zandrini (1679—1747), Venetian mathematician coming from Valle Camonica (Southern Italian Alps), Guglielmini’s pupil, contributed to the hydraulic and hydrological science both designing important engineering works (*viz* the reclamation of the plain of Viareggio, the *Murazzi* sea walls in Venice, the diversion of Ronco and Montone rivers to protect the city of Ravenna) and with a great literature production, the major opus and masterpiece of which is the treatise *Laws and phenomena, regulations and uses of running waters* (*Leggi e fenomeni, regolazioni ed usi delle acque correnti*, published by Giambattista Pasquali, Venice, 1741).

The treatise marks a turning point in the Italian hydraulic and hydrological tradition, because the description of the phenomena, deeply rooted in a traditional geometrical approach, as it was common in the previous works, is proposed in terms of the modern calculus approach, as it was being developed in the same age in Northern Europe.

A role of major importance, within the treatise, is played by the flow–rate measurement techniques, to which it is devoted the long fifth chapter, divided into two parts with two appendices. After a review of the past and contemporary literature about flow–rate measurements (first part of the chapter), in the second part the pendulum method (*palla a pendolo* method) is introduced, described and discussed in its effectiveness at properly measure the flow rate.

Aiming at deepening the underlying epistemological aspects and understandings of the ancient hydraulic and hydrological science, we will present in this paper (*i*) an analysis of the theoretic base and of the procedure proposed by Zandrini to determine the flow rate by means of the pendulum method, and (*ii*) some didactic experiences performed to rebuild and use an effective pendulum according to Zandrini’s suggestions.