



Benedetto Castelli (1578 – 1643) and “*Della misura dell’acque correnti*”

Roberto Ranzi, Marco Peli, and Stefano Barontini

Universita' degli Studi di Brescia, DICATAM-Dipartimento di Ingegneria Civile, Architettura, Territorio, Ambiente e di Matematica, Brescia, Italy (roberto.ranzi@unibs.it)

Benedetto Castelli (Brescia, 1578 – Rome, 1643), born Antonio Castelli, benedictine monk, begun his mathematics studies in Brescia and completed them at the University of Padua.

At first Galilei's pupil in Padua, then friend and assistant in Florence, in 1613 he became professor at the University of Pisa and in 1625 moved (called by the Pope Urban VIII) to the Sapienza University of Rome. During his lifetime he contributed to some of Galilei's works on physics and astronomy, and dealt with mathematics and geometry, philosophy and magnetism.

He gave his most important contribution to the hydraulics and hydrological science, both with his activity as a water engineering consultant for the Reno river diversion and with his literature production. He designed the first rain gauge known in Europe for solving a hydrological engineering problem related to the draught of the Trasimeno Lake, which could prevent the operation of water mills on its outlet. His masterpiece “*Della misura dell’acque correnti*”, about streamflow measurement, was actually published in two books. The first book, published in Rome in 1628, contains the description of his re-discovery of the formulation of the discharge in a river as the product of average velocity and area of the cross section, a concept which was already clear at the time of the ancient Greek philosophers, but was later forgotten. Then, developing this concept, he provided very clever solutions to land reclamation and river training problems at river junctions, where a change of the cross section results in different sediment deposition rates. The final edition, published in Bologna in 1660 (and the following year in London, once translated), added a second book where he proposed a stage discharge curve, assuming a linear relationship between velocity and water depth.

His contribution to hydraulics, hydrology and to science in general passed also through his academic legacy to which, as a scholar, he fostered Galilei's approach and ideas. When professor at the University of Pisa, he was the first academic advisor of Bonaventura Francesco Cavalieri, future inventor of the cavalier perspective and proposer, through the method of indivisibles, of an early step towards integral calculus. When teaching at the Sapienza University of Rome he was the master of, among others, Giovanni Alfonso Borelli and Evangelista Torricelli. The first is today considered the father of biomechanics, i.e. the study of animal movement, while the second is recognized as the inventor of the barometer, and proposed the basic law of foronomy $v = \sqrt{2gh}$, describing the speed v of a fluid flowing out of a tank through an opening located at a depth h from the water surface.

Castelli also defended Galileo Galilei when he had to appear to the court in Rome for his famous trial.