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Colin Maclaurin (1698–1746) and his contemporaries on wind and water: the local and the universal. (English. English summary)

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The primary figure in this informative and wide-ranging study is the Scottish mathematician Colin Maclaurin. Earlier savants and several of Maclaurin's contemporaries also receive some attention, including Antoine Parent, Willem 's Gravesande (S'Gravesande here), Daniel Bernoulli, Bernard de Belidor and John Desaguliers. The focus is on mathematical and engineering work in hydraulics and wind technology. Secondary works of note include Terry Reynolds' history of water wheels, Olivier Darrigol's history of fluid mechanics and George Smith's study of Book 2 of Newton's *Principia*. Historian Judith Grabiner has explored the themes of locality and social position in Maclaurin's scientific work.

In 1704 Parent analyzed the performance of a water wheel and deduced that maximum power (to use a modern term) is achieved when the speed of the wheel is one third the speed of the water powering the wheel. He reasoned as follows. The pressure p exerted by the water on the wheel is a function of the difference between the speed V of the water and the speed v of the wheel: $p = k(V - v)^2$, where k is a constant. (How Parent arrived at this law is not explained in the article.) The power of the wheel is then given by the quantity pv. We have $pv = kv(V - v)^2$. Regarding this expression as a function of v, we differentiate with respect to v and set the result equal to 0. We find in this way that the maximum power occurs when v equals $(1/3)V$. To exert maximum power, the wheel should move with a speed equal to one third of the speed of the water. It is noteworthy that Parent's mathematical treatment of this technological problem appeared just twenty years after Leibniz's original publication of his differential algorithm.

Parent's result was adopted by subsequent researchers including Maclaurin in 1742. The latter used the fluxional calculus and the same method of maxima and minima as Parent to obtain the result. He also introduced some refinements into his analysis of the problem.

Historians Jane Jacobs and Larry Stewart have called attention to a shift that took place as the eighteenth century progressed from an emphasis on mathematical theory to a greater engagement with empirical practice. Maclaurin's investigations fell on the mathematical side of this divide. The shift from theory to practice was more pronounced in Britain than it was in France. However, the author suggests that this conclusion may need to be qualified as more information about earlier French experimental practice becomes available. The author notes that Maclaurin was at no particular geographic disadvantage relative to other European researchers by being in Edinburgh, despite what he may have thought.

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