

Origin of the Experiment of Impact with Pendulums

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It is well known that Galileo's experiments on the pendulum resulted in discoveries which played fundamental roles in the formation of classical mechanics. Galileo discovered the isochronism of the pendulum, which he later employed for the measurement of time; by comparing the oscillations of two pendulums of the same length having bobs made of different matters, he also established that the acceleration of falling bodies was always the same regardless of their density, size and shape; finally from an experiment which showed that the pendulum ascended to the same height as the starting point of descent, even when a part of the thread of the pendulum was fixed by a protruding nail during its oscillation, he inferred that the velocities acquired by falling bodies depend only on the vertical height of their fall. It might well be said that the Galilean mechanics would not have emerged without experiments on the pendulum. It is therefore quite natural that the great significance of the experiment on the pendulum for the Galilean mechanics has been repeatedly stressed and that the historic origin of the experiment on the pendulum has been eagerly studied.

It seems, however, that the origin of the experiment of impact with pendulums has scarcely studied, though it also played an important role in the formation of classical mechanics.¹ The historical importance of this experiment will easily be understood, if we consider that it was the only experiment in the seventeenth and eighteenth centuries that could produce an exact numerical result, and that it finally settled the long controversy about the theory of impact which had begun immediately after the publication of Descartes' *Principia Philosophiae* (1644).

Among the books of that time in which the experiment of impact with pendulums is treated in some detail, Newton's *Principia* is best known. In the scholium following the second preliminary section 'Axioms, or Laws of Motion' of the *Principia*, Newton describes an experiment with two pendulums to study

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¹ For example, R. Dugas makes any mention of the origin of the experiment of impact with pendulums neither in his *Histoire de la Mécanique*, Neuchatel, 1950, nor in his *Mécanique au XVII^e Siècle*, Neuchatel, 1954.