

## A GENERAL FORM OF THE SUSPENSION BRIDGE CATENARY

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1. *Introduction.* The form of the curve assumed by a uniform chain or string hanging freely between two supports was first investigated by Galileo, who erroneously determined it to be a parabola; Jungius detected Galileo's error, but the true form was not discovered until 1691, when James Bernoulli published it as a problem in the *ACTA ERUDITORUM*. He also considered the cases when the chain was (1) of variable density, (2) extensible, (3) acted upon at each point by a force directed to a fixed center.

These curves attracted much attention, and were discussed by John Bernoulli, Leibnitz, Huygens, David Gregory and others. A review of the literature shows, however, that in the problem of the inextensible string acted upon by gravitational forces, only two special cases are considered:—the case where there is simply a string of uni-form linear density, and the case of a string of inappreciable weight supporting a uniform horizontal load. Moreover, the modern text-books in the subject appear to shun a more general case, and content themselves with presenting only the two very special cases mentioned.

The object of the present paper is to consider what happens when a cable of appreciable uniform linear density supports a uniform horizontal load, conditions that are very nearly realized in the suspension-bridge. The texts solve the special cases by the solution of two first-order

