

Abstract Submitted
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Analyzing the Experience of Riding a Roller Coaster Loop¹

PAULA GALVEZ MOLINA, JORGE BALLESTER, Emporia State University —
The goal of this project is to model the acceleration and jerk (first derivative of acceleration) by a rider on a roller coaster loop. The motivation is to enhance the experience as well as the safety of the ride. An adjustable loop was generated using Python and constructed using segments of a clothoid (Cornu spiral) and a circle. The clothoid minimizes the jerk by gradually transitioning from a horizontal straight line to a final target radius by varying the radius of curvature. The parameter for generating the loop was arc length. The velocity along each point of the ride was calculated using the work-energy theorem and then the time was calculated numerically. All vector quantities were calculated using a normal-tangential coordinate system. A weighted average of the forward and backward differentiation methods was used for calculating the acceleration and jerk along each point. The most conclusive result points to an inversely proportional relation of the height and jerk, while relations of the x and y components of the g-force are yet to be further studied.

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Paula Galvez Molina
Emporia State University

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