Numerical Simulations of Action Principle

Refath Bari

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Abstract

The Principle of Least Action (PLA) can be confusing to students, in part due to
e Calculus of Variations, but also because of the subtleties of the actual principle.
an there exist two local minimums? Do different observers in different IRFs (Inertial
ference Frames) calculate different actions? Is action a tangible entity like velocity?
an effort to address the questions and misconceptions that can arise from the Action
inciple, I develop three numerical simulations that put the PLA to use: light reflecting
equal angles, light refracting in different mediums, and light moving between two
ints in the least time.

ntroduction

ion Principle can be difficult for students, in particular because of its abstract nature
of exposure to students. The action itself could be hard to digest, given its intangible
unlike velocity or even acceleration which can be understood intuitively [2]. Students
confused as to why the Lagrangian must be T-V instead of T+V, as mechanical
s [4]. They may be confused by the abstraction of "nearby paths" and why light
nply travel in straight lines to minimize distance [8]. Furthermore, the Calculus
tions is not about minimizing a variable, but a function, which can be difficult for
to comprehend [3] — especially when applied to the nearby paths of the PLA.
s are not given adequate time to understand Variational Calculus before it's applied
ics, as PLA and COV are often simultaneously introduced, exacerbating student