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What Projective Angle Makes the Arc-Length of the Trajectory in a Resistive Media Maximum? A reverse engineering approach

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We consider the motion of a massive point-like projectile thrown with initial velocity with respect to horizontal in a two dimensional vertical plane under the influence of gravity in a viscose media. Two different velocity-dependent resistive media models are considered – linear and quadratic. With an objective to utilizing a Computer Algebra System (CAS), specifically Mathematica [1] numerically we solve the corresponding equations of motions. For a set of compatible parameters characterizing viscose forces graphically we display comparing the trajectories explicitly showing the impact of the models. Utilizing the model-dependent trajectory equations numerically we evaluate their associated arc-lengths. What distinguishes our approach vs. the existing body of work is the notion of the "reverse engineering". Meaning, utilizing our numeric data we establish their corresponding analytic counter parts. Ultimately, utilizing both output numerically and analytically we determine the matching initial projectile angles maximizing their respective arc-lengths.

References

[1] Stephen Wolfram, *Mathematica* "A general computer software system and language intended for mathematical and other applications",V12.0, Wolfram Research, 2019.