

Optimal thrust control for the Modified Brachistochrone Problem

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Abstract: The brachistochrone problem with penalty for fuel expenditures of mass-point moving in the vertical plane driven by gravity, nonlinear viscous drag, and thrust is considered. The lifting force or normal component of the reaction force of the curve and the thrust are considered as a control variables. Principle maximum procedure allows to reduce the optimal control problem to the boundary value problem for a set of systems of two nonlinear differential equations. The qualitative analysis of the resulting system allows to study the key features of the extremal trajectories, including asymptotic behavior. Thrust control depending on the velocity and slope angle is designed. The structure of the extremal thrust control program is determined and consequence of the subarcs is established analytically.

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