First Integrals and Closed-form Solutions of Some Singular Optimal Control Problems

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Abstract

This article analyze singular optimal control problems (SOCP) from different areas of engineering and applied mathematics. We use the notion of partial Hamiltonian and we show that every singular optimal control problem can be written in the form of current value or standard Hamiltonian. The partial Hamiltonian approach is used to compute the partial Hamiltonian operators and first integrals. Then these first integrals are utilized to construct the closed-form solutions of hybrid vehicle optimal energy management model, optimal harvesting mathematical model and model of membrane filtration system. We explain how one can use partial Hamiltonian approach for both finite horizon and infinite horizon systems. This study provides a new way of solving singular optimal control problems.

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