A global optimization approach to fractional optimal control.


Summary: In this paper, we consider a fractional optimal control problem governed by a system of linear differential equations, where its cost function is expressed as the ratio of convex and concave functions. The problem is a hard nonconvex optimal control problem and application of Pontryagin’s principle does not always guarantee finding a global optimal control. Even this type of problems in a finite dimensional space is known as NP hard. This optimal control problem can, in principle, be solved by Dinkhelbach algorithm [10]. However, it leads to solving a sequence of hard D.C programming problems in its finite dimensional analogy. To overcome this difficulty, we introduce a reachable set for the linear system. In this way, the problem is reduced to a quasiconvex maximization problem in a finite dimensional space. Based on a global optimality condition, we propose an algorithm for solving this fractional optimal control problem and we show that the algorithm generates a sequence of local optimal controls with improved cost values. The proposed algorithm is then applied to several test problems, where the global optimal cost value is obtained for each case.

Keywords: optimality condition; fractional programming; optimal control
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