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Second Chebyshev wavelets (SCWs) method for solving finite-time fractional linear quadratic optimal control problems. (English) [Zbl 07431520]


Summary: In this paper, we present an indirect computational procedure based on the truncated second kind Chebyshev wavelets for finding the solutions of Caputo fractional time-invariant linear optimal control systems which the functional cost consists of the finite-time quadratic cost function. Utilizing the operational matrices of second Chebyshev wavelets (SCWs) of the Riemann-Liouville fractional integral, the corresponding linear two-point boundary value problem (TPBVP), obtained from the fractional Euler-Lagrange equations, is reduced to a coupled Sylvester-type matrix equation. An equivalent linear matrix form using the Kronecker product is constructed. The upper bound of the error of the SCWs approximation and the convergence of the proposed method are investigated. Low computational complexity and flexible accuracy are two important superiorities of this approach. Numerical experiments provide satisfactory results compared to the exiting techniques.

MSC:

65-XX  Numerical analysis
49-XX  Calculus of variations and optimal control; optimization

Keywords:

fractional optimal control problem; linear quadratic; Euler-Lagrange equations; second Chebyshev wavelets (SCWs); left and right operational matrices

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References:


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