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A new formula for fractional integrals of Chebyshev polynomials: application for solving multi-term fractional differential equations. (English) Zbl 1278.65096

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The authors construct an approximate method to solve the differential problem of the form

$$D^{\nu}u(x) + \sum_{i=1}^{r-1} \gamma_i D^{\beta_i} u(x) + \gamma_r u(x) = g(x) \qquad \text{in } (0, L),$$

$$u^{(i)}(x) = d_i, \quad i = 0, 1, \ldots, m-1, \quad 0 < \beta_i < \nu, \quad m-1 < \nu \leq m,$$

where the derivatives D^{ν} and D^{β_i} denote the Riemann-Liouville fractional derivatives. The approximate method is constructed using the expansion of the solution by a system of Chebyshev orthogonal polynomials and the notion of integration of fractional order.

Reviewer's remark: The numerical examples given in this article are not sufficient to prove the convergence of the method.

Reviewer: Ivan Secrieru (Chişinău)

MSC:

65L05 Numerical methods for initial value problems
65L03 Numerical methods for functional-differential equations
34A08 Fractional ordinary differential equations and fractional differential inclusions
34A30 Linear ordinary differential equations and systems, general

Cited in **37** Documents

Keywords:

tau method; shifted Chebyshev polynomials; Chebyshev-Gauss quadrature; fractional differential equation; initial value problem; Fourier expansion of solution; Riemann-Liouville fractional derivative; numerical examples

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