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Research Article

Existence and Uniqueness of Solutions for Coupled Systems of Higher-Order Nonlinear Fractional Differential Equations

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We study an initial value problem for a coupled Caputo type nonlinear fractional differential system of higher order. As a first problem, the nonhomogeneous terms in the coupled fractional differential system depend on the fractional derivatives of lower orders only. Then the nonhomogeneous terms in the fractional differential system are allowed to depend on the unknown functions together with the fractional derivative of lower orders. Our method of analysis is based on the reduction of the given system to an equivalent system of integral equations. Applying the nonlinear alternative of Leray-Schauder, we prove the existence of solutions of the fractional differential system. The uniqueness of solutions of the fractional differential system is established by using the Banach contraction principle. An illustrative example is also presented.