THE NONLOCAL KOSHY PROBLEM FOR THE RICCATI EQUATION OF THE FRACTIONAL ORDER AS A MATHEMATICAL MODEL OF DYNAMICS OF SOLAR ACTIVITY

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In the work of a mathematical model, the dynamics of solar activity of 23 and 24 cycles at the stage of rise is investigated. The mathematical model is the Cauchy problem for the Riccati equation with a fractional derivative, a constant value of the order of the fractional derivative, and variable coefficients. The analysis of the initial data is presented in order to highlight the studied area. The solution to this mathematical model is presented numerically using the Newton method. The resulting solution is compared, using a cubic spline, with the experimental data of solar activity of 23 and 24 cycles. Next, using the least square method, the optimal value of the order of the fractional derivative is selected at which the coefficient of determination reaches the maximum value. It is shown that the proposed model is in good agreement with the dynamics of solar activity of 23 and 24 cycles during the rise and allows us to highlight its trend. It has been suggested that the dynamics of solar activity at the elevation stage may have memory effects.

Key word: fractional calculus, heredity, numerical methods, solar activity, Riccati equation.

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