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Special functions in fractional relaxation-oscillation and fractional diffusion-wave phenomena. (English) Zbl 0921.33009

Bainov, D. (ed.), Proceedings of the 8th international colloquium on differential equations, Plovdiv, Bulgaria, August 18–23, 1997. Utrecht: VSP. 195-202 (1998).

Basic processes in mathematical physics like relaxation, diffusion, oscillations and wave propagation have been generalized by introducing fractional derivatives in the governing differential equations. The authors define the fractional derivative of order α, $\alpha > 0$, of a causal function $f(t)$ ($f(t) = 0$ for $t < 0$) by $d^\alpha/dt^\alpha f(t) = f^{(n)}(t)$ if $\alpha = n \in \mathbb{N}_0$, and $d^\alpha/dt^\alpha f(t) = (1/\Gamma(n-\alpha)) \int_0^t f^{(n)}(\tau)/(t-\tau)^{\alpha+1-n} d\tau$ if $n-1 < \alpha < n$. In this paper the solutions of the fractional ordinary differential equations $d^\alpha u/dt^\alpha + \omega^\alpha u(t;\alpha) = 0$, $0 < \alpha \leq 2$, and the fractional partial differential equation $\partial^{2\beta} u/\partial t^{2\beta} = D\partial^2 u/\partial x^2$, $-\infty < x < \infty$, $0 < \beta \leq 1$ are obtained by applying the classical technique involving the Laplace transform. Interesting properties of the solutions and relationships with the functions of Fox and Wright are proved.

For the entire collection see [Zbl 0896.00024].

Reviewer: O.Fekete (Freiburg)

MSC:

33E20	Other functions defined by series and integrals
26A33	Fractional derivatives and integrals
45J05	Integro-ordinary differential equations
70J99	Linear vibration theory
33C60	Hypergeometric integrals and functions defined by them (E, G, H and I functions)

Cited in **32** Documents