

Variable Order Fractional Differential Equations: Theory and Applications

A. M. Nagy[†]

[†]Department of Mathematics, Faculty of Science, Benha University, 13518 Benha, Egypt.
abdelhameed_nagy@yahoo.com

ABSTRACT

Fractional calculus is a discipline that studies integrals and derivatives of non-integer (real or complex) order [1]. The fractional calculus has allowed the operations of integration and differentiation to any complex orders. This fact enables us to consider the order of the fractional derivatives to be a function of time, space or some other variables, rather than a constant of arbitrary order [2, 3]. Compared with constant-order fractional systems, the investigation of variable-order (VO) systems has not received much attention. Research on the solution of variable fractional order partial differential equations is relatively new, and numerical approximation of these equations is still at an early stage of development.

In this talk, a survey will be given to the theory of variable-order fractional differential equations (VOFDEs). Since the variable-order fractional derivatives contain classical and fractional derivatives as special cases, many existence and uniqueness results of references are significantly generalized. Moreover, we focus on real life models of the fractional differential equation models. A variable-order nonlinear cable equation has been considered. Finally, the numerical results of the given problem are presented.

References

- [1] A. A. Kilbas, H. M. Srivastava, J. J. Trujillo, Theory and applications of fractional differential equations. North-Holland Mathematics Studies, 204, Elsevier, Amsterdam, 2006.
- [2] C.F. Lorenzo, T.T. Hartley, Variable order and distributed order fractional operators. *Nonlinear Dynam.* 29 (2002) 57.
- [3] L.E.S. Ramirez, C.F.M. Coimbra, , A variable order constitutive relation for viscoelasticity. *Ann. Phys. (Leipzig)* 16 (7-8) (2007) 543.