A change of perspective in variable-order fractional calculus
Roberto Garrappa (University of Bari), Andrea Giusti, Francesco Mainardi
R 3.28 Tue Z2 14:50-15:30

In the last two or three decades different approaches to introduce fractional integrals and derivatives of variable-order have been investigated. Fractional variable-order operators are indeed useful to model a series of physical phenomena in which persistent memory effects or anomalous properties change over time and/or space.

Starting from some preliminary ideas by the Italian engineer Giambattista Scarpi, in this talk we present a new approach for generalizing standard fractional operators of constant order α to variable order $\alpha(t)$. Rather than operating directly in the time domain, the proposed approach performs the generalization in the Laplace transform domain. Moreover, the obtained variable-order differential and integral operators are framed in the robust mathematical theory of General Fractional Derivatives and Integrals relying on the Sonine condition.

The absence of an analytical time-domain representation of these variable-order operators forces us to an extensive use of numerical methods for the inversion of the Laplace transform and for the solution of differential equations which will be discussed in details.

References

[1] Garrappa, R., Giusti, A., Mainardi, F.: Variable-order fractional calculus: a change of perspective. Commun. Nonlinear Sci. Numer. Simul. 102, 105904 (2021)