

FDEs and FPDEs: stability results, diffusive representations and applications

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Results on stability of linear FDEs will be recalled in the case of commensurate orders; and a structure theorem for the solutions will be given in the case of uncommensurate orders, thus leading in a natural way to the notion of diffusive representation, or so-called relaxation spectrum of a system.

Then, the fractional integrals and derivatives will be considered alone, and their diffusive representations will be derived; both input-output relation and state-space realizations will be computed.

The latter will be used to transform FDEs or FDPEs into coupled systems that are more easily studied thanks to a Lyapunov functional, especially well-posedness. As far as asymptotic stability is concerned, a more involved characterization has to be used, due to the lack of compactness underlying the diffusive formulation.

The end of the talk will be devoted to more recent results (anti-causal systems, fractional Laplacian) as well as open problems.