

# Smooth solutions to mixed-order fractional differential systems with applications to stability analysis

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Conditions for existence, uniqueness and smoothness of solutions for systems of fractional differential equations of Caputo and/or Riemann-Liouville type having all of them in general and not of the same derivation order are established in this paper. It includes mixed-order, multi-order or non-commensurate fractional systems. The smooth property is shown to be relevant for drawing consequences on the global behavior of solutions for such systems. In particular, we obtain sufficient conditions for global boundedness of solutions to mixed-order nonlinear systems and asymptotic stability of nonlinear fractional systems using backstepping control.