Multivalue numerical methods for stiff differential problems

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This talk focuses on the numerical solution of differential equations characterized by stiffness deriving from real phenomena and physical processes. Stiff problems can arise when dealing, for example, with partial differential equations with advection or diffusion terms. We show the application of numerical techniques leading to methods equipped with excellent stability properties, also capable of preserving the qualitative features of the solution [3, 4].
Recent numerical techniques for the construction of efficient and stable methods involve the modification of the classical coefficients which become Jacobian-dependent matrices [5]. In this field, the Time-Accurate and Highly-Stable-Explicit (TASE) Runge-Kutta methods are derived by modifying the problem to be solved by introducing an appropriate operator [2]. We show that it is possible to derive highly stable multivalue methods using the TASE technique and other methodologies [1, 4].

The presented results have been obtained in collaboration with Beatrice Paternoster, Leila Moradi and Giovanni Pagano (University of Salerno), Raffaele D'Ambrosio (University of L'Aquila), Fakhrodin Mohamadi (University of Hormozgan, Iran), Ali Abdi (University of Tabriz, Iran).

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