Collocation based numerical methods for Volterra integro-differential equations

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We present multistep collocation based numerical methods for Volterra Integro-Differential Equations (VIDEs). Multistep collocation methods and several modifications have already been proposed for ordinary differential equations [3] and for Volterra integral equations [1, 2]. These methods allow to increase the uniform order of convergence with respect to classical one-step collocation methods, at the same computational cost. We extend the analysis of multistep collocation methods to VIDEs with the aim of combining high accuracy with good stability properties. We analyze the convergence properties of the constructed methods and carry out the numerical stability with respect to the basic test equation and to test equation with decomposable kernel. Moreover classes of A_0-stable methods are provided. Numerical experiments confirm theoretical expectations and make comparisons with the one-step collocation methods.

References

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