A Matrix-free implementation of Multistep Runge-Kutta code

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A matrix-free implementation for solving stiff ordinary differential equations (ODEs) can be more effective than the implementations which rely on direct linear algebra techniques to solve the implicit equations governing the stage values. Fully implicit and high order Runge-Kutta methods can be efficiently implemented in matrix-free fashion, as has been shown by Burrage et al (1997). In this talk, we present our work adopting the matrix-free technique to improve our parallel iterated Multistep Runge-Kutta (MRK) code VMRK. The numerical results show the efficacy of our new code, VMRKPK, over VMRK and VMRAD, the standard implementation of the MRK method.