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Composition explicit methods for stiff ordinary differential equations. (English)

Zbl 0968.65046


Summary: This paper discusses explicit embedded integration methods with large stability domains of order 3 and 4. The high-order produces accurate results, the large stability domains allow some reasonable stiffness, the explicitness enables the method to treat very large problems, often space discretization of parabolic partial differential equations, and the embedded formulas permit an efficient stepsize control.

The construction of these methods is achieved in two steps: firstly, we compute stability polynomials of a given order with optimal stability domains, i.e., possessing a Chebyshev alternative; secondly, we realize a corresponding explicit Runge-Kutta method with help of the theory of composition methods.

For the entire collection see [Zbl 0954.00042].

MSC:

65L05 Numerical methods for initial value problems involving ordinary differential equations
65L06 Multistep, Runge-Kutta and extrapolation methods for ordinary differential equations
35K55 Nonlinear parabolic equations
65L20 Stability and convergence of numerical methods for ordinary differential equations
34A34 Nonlinear ordinary differential equations and systems

Keywords:

stiff system; method of lines; parabolic equations; explicit methods; large stability domains; stepsize control; Runge-Kutta method