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ON DIFFERENCE SCHEMES FOR QUASILINEAR EVOLUTION PROBLEMS*

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Abstract. We review several methods leading to variable-coefficient schemes and/or to exact difference schemes for ordinary differential equations (error elimination; functional fitting; Principle of Coherence). Necessary and suffient conditions are given for t-independence of fitted RK coefficients. Conditions for τ-independence are investigated, τ the time-step. The theory is illustrated by examples. In particular, examples are given for non-uniqueness of exact schemes and for efficient difference schemes based on exact schemes and well suited for highly oscillatory ordinary differential systems or for parabolic equations with blow-up solutions.

Key words. difference schemes, time stepping, nonstandard schemes, exact schemes, exponential fitting, functional fitting, Runge-Kutta, collocation methods, review

AMS subject classifications. 65L05, 65M06, 65P99

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