

ANALYSIS OF THE LINEARLY IMPLICIT MID-POINT RULE FOR DIFFERENTIAL-ALGEBRAIC EQUATIONS *

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Abstract. The error of the linearly implicit mid-point rule after $2m + 1$ steps is expanded in powers of m^2 . We prove that the well-known expansion for ordinary differential equations (an expansion in negative powers of m^2) is perturbed by additional terms with non-negative powers of m^2 for semi-explicit differential-algebraic equations of index one. Hence, extrapolation in m^{-2} will be of limited value only. The complete expansion shows these limits and, furthermore, can be used to derive an order 8 method of Rosenbrock type.

Key words. Differential-algebraic equations, linearly implicit mid-point rule, Rosenbrock-type methods, extrapolation.

AMS subject classifications. 65L05, 65B05, 58F99.

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