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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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