



## DISCONTINUITY PROPAGATION IN DELAY DIFFERENTIAL-ALGEBRAIC EQUATIONS\*

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**Abstract.** The propagation of primary discontinuities in initial value problems for linear delay differential-algebraic equations (DDAEs) is discussed. Based on the (quasi-) Weierstraß form for regular matrix pencils, a complete characterization of the different propagation types is given and algebraic criteria in terms of the matrices are developed. The analysis, which is based on the method of steps, takes into account all possible inhomogeneities and history functions and thus serves as a worst-case scenario. Moreover, it reveals possible hidden delays in the DDAE and allows to study exponential stability of the DDAE based on the spectral abscissa. The new classification for DDAEs is compared to existing approaches in the literature and the impact of splicing conditions on the classification is studied.

**Key words.** Delay differential-algebraic equations, Differential-algebraic equations, Classification of DDAEs, Primary discontinuities, Splicing conditions, Exponential stability.

**AMS subject classifications.** 34A09, 34A12, 34K06, 65H10.

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