Differential-algebraic equations with delay - 
A 25 minute-journey

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Abstract

This talk aims at linear time-invariant delay differential-algebraic 
equations (DDAEs) of the form

\[ A_k x^{(k)}(t) + \cdots + A_0 x(t) + A_{-1} x(t - \tau) + \cdots + A_{-\kappa} x^{(\kappa)}(t - \tau) = f(t), \quad (1) \]

and its special case

\[ A_1 \dot{x}(t) + A_0 x(t) + A_{-1} x(t - \tau) = f(t). \quad (2) \]

Surprisingly, already in order to deal with (2), it is necessary to study 
linear high-order differential-algebraic equations of the form

\[ A_m x^{(m)}(t) + \cdots + A_0 x(t) = f(t), \quad (3) \]

for different orders \( m \). Therefore, in the first part of the talk, we 
study system (3). The second part of the talk is about the solvability 
analysis of systems (1) and (2). The key tool of our analysis here is 
the combination of algebraic and behavior approaches [1, 2, 3].

References

