On the stability of Radau IIA collocation methods for delay differential equations

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In this talk we investigate the stability of Radau IIA collocation methods for delay differential equations (DDEs). Here, for the delay argument we consider the interpolation procedure (studied e. g. in [4], [3], [2]), which uses continuous extensions of the considered Runge-Kutta method. We use the term *stability* to indicate the situation where the stability region S (defined e. g. in [3]) of the considered method, contains the set $\{(x,y) \in \mathbb{C}^{\not\in} : \mathrm{Re}(\curvearrowleft) < -|\curvearrowright|\}$, which is relavant to the test equation

$$U'(t) = \lambda U(t) + \mu U(t-\tau), \quad t \geq 0,$$

(λ, $\mu \in \mathbb{C}$, $\mathrm{Re}(\lambda) < -|\mu|$, $\tau > 0$) and arbitrary stepsizes $h > 0$.

It is proved in [3] that collocation methods for DDEs with abscissae in $[0,1)$ are not stable in the above sense. Radau IIA collocation methods for DDEs are not included in the class of the methods studied in [3]. It is known ([1]) that the 1-stage Radau IIA collocation method for DDEs is stable. The aim of our talk is to answer the question, whether or not, Radau IIA collocation methods are stable. The results come from a joint work with K. J. in't Hout.

References

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