Numerical solution of fractional differential equations by spline collocation methods

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We consider the fractional differential problem

$$\begin{cases} D^\alpha y(t) = f(t, y(t)), & 0 \le t \le b, \\ y^{(i)}(0) = \gamma_i, & i = 0, \ldots, n-1, \end{cases}$$

where $n - 1 < \alpha < n$, $n \in \mathbb{N}$ and $D^\alpha y$ is the Caputo-type fractional derivative. We illustrate the numerical solution by spline collocation methods [1–4]. We investigate convergence properties and numerical stability with respect to the basic test equation. Several numerical experiments are provided to confirm theoretical expectations and to make comparison between one and two step spline collocation methods.

References

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