Ramos, Higinio; Rufai, Mufutau Ajani
An adaptive pair of one-step hybrid block Nyström methods for singular initial-value problems of Lane-Emden-Fowler type. (English) Zbl 07442888

Summary: In this paper, an optimized pair of hybrid block techniques is presented and successfully applied to integrate second-order singular initial value problems of Lane-Emden-Fowler type emanating from applied sciences and engineering. An adaptive technique implementation is considered. One of the proposed one-step hybrid block techniques is obtained by using three intermediate points. The obtained block formulas are then paired with a suitable set of formulas applied at the first step to avoid the singularity issue at the left end of the integration interval. Some real-world application problems, including the well-known isothermal gas sphere’s equations, are integrated numerically to ascertain our developed error estimation and control strategy impact. The presented numerical simulations confirm the superiority and robust performance of the proposed scheme.

MSC:
65-XX Numerical analysis
93-XX Systems theory; control

Keywords:
hybrid block technique; Nyström-type method; Lane-Emden-Fowler equation; optimization strategy; starting procedure; adaptive formulation

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References:


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