Symmetric variable-stepsize linear multistep methods for second-order systems

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It is well known that symmetric methods take good profit of the reversibilities of Hamiltonian systems. It has been proved that symmetric fixed-stepsize linear multistep methods for second-order systems which do not have any parasitic root in their first characteristic polynomial give rise to a slow error growth with time when integrating reversible systems. We show now that the same happens when variable stepsizes are considered. We also offer an effective general technique to construct those variable-stepsize linear multistep methods from their fixed-stepsize counterparts so that order and symmetry are conserved. As this technique looks for efficiency, we concentrate on explicit linear multistep methods, which just make one function evaluation per step, and we offer some numerical comparisons with other optimal one-step adaptive methods which also show a good long-term behaviour.