

Energy preserving methods for Poisson systems

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Abstract

We present and analyze energy-conserving methods for the numerical integration of IVPs of Poisson type systems that are able to preserve some Casimirs. Their derivation and analysis is done within the framework following the ideas of Hamiltonian BVMs (HBVMs) (see [1] and references therein). The proposed methods turn out to be equivalent to those recently derived in [2], giving therefore an alternative point of view that provides additional insight on the methods. Sufficient conditions that ensure the existence of a unique solution of the implicit equations defining the formulae are given. A study of the implementation of the methods is provided. In particular, order and preservation properties when the involved integrals are approximated by means of a quadrature formula, are derived.

References

- [1] L. Brugnano, F. Iavernaro and D. Trigiante. The Hamiltonian BVMs (HBVMs) Homepage, [arXiv:1002.2757](https://arxiv.org/abs/1002.2757).
(URL: <http://www.math.unifi.it/~brugnano/HBVM/>).
- [2] D. Cohen, E. Hairer. Linear energy-preserving integrators for Poisson systems. *BIT Numer. math.* **51**, 1 (2011) 91–101.