

THE AROMATIC BICOMPLEX FOR THE STUDY OF INTEGRATORS THAT EXACTLY PRESERVE  
THE INVARIANT MEASURE

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For the approximation of ergodic stochastic differential equations (SDEs), there exists a methodology for the creation of high-order schemes for sampling the invariant measure. One then wonders if there exists a scheme that preserves the invariant measure exactly, in the spirit of exact volume preservation for ODEs. While B-series (resp. exotic B-series) are used to represent the Taylor expansion of the solution of ODEs (resp. SDEs), aromatic B-series (resp. exotic aromatic B-series) appear in the creation of integrators that preserve the invariant measure of ODEs (resp. ergodic SDEs). In this talk, we define aromatic forms and the aromatic bicomplex, in the spirit of the variational bicomplex in differential geometry. We prove the exactness of this bicomplex and use it to give an explicit description of volume-preserving methods. We use this description to show that no aromatic modification of Runge-Kutta methods preserves volume in general and to discuss the possible ansatz for creating methods that preserve the invariant measure exactly.

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