

SYMPLECTIC RUNGE-KUTTA METHODS FOR NONSYMPLECTIC PROBLEMS

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Symplectic Runge-Kutta and Partitioned Runge-Kutta methods exactly preserve quadratic first integrals (invariants of motion) of the system being integrated. While this property is often seen as a mere curiosity (it does not hold for arbitrary first integrals), it plays an important role in the computation of numerical sensitivities, optimal control theory and Lagrangian mechanics. Some widely used procedures, such as the direct method in optimal control theory and the computation of sensitivities via reverse accumulation imply hidden integrations with symplectic Partitioned Runge-Kutta schemes.