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Difference Discrete Variational Principle in Discrete Mechanics and Symplectic Algorithm

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Abstract: We propose the difference discrete variational principle in discrete mechanics and symplectic algorithm with variable step-length of time in finite duration based upon a noncommutative differential calculus established in this paper. This approach keeps both symplecticity and energy conservation discretely. We show that there exists the discrete version of the Euler-Lagrange cohomology in these discrete systems. We also discuss the solution existence in finite time-length and its site density in continuous limit, and apply our approach to the pendulum with periodic perturbation. The numerical results are satisfactory.

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