Numerical evaluation of ODE solutions by Monte Carlo enumeration of Butcher series

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We present an algorithm for the numerical solution of ordinary differential equations by random enumeration of the Butcher trees used in the implementation of the Runge-Kutta method. Our Monte Carlo scheme allows for the direct numerical evaluation of an ODE solution at any given time within a certain interval, without iteration through multiple time steps. In particular, this approach does not involve a discretization step size, and it does not require the truncation of Taylor series.

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