

Structure-preserving numerical methods for Fokker-Planck equations

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A common way to numerically solve Fokker–Planck equations is the Chang–Cooper method combined with the Euler methods. However, the explicit Euler method is not unconditionally positive, and severe restrictions on the time step are needed to ensure the positivity of the scheme, and the implicit Euler method is in general non-linearly implicit. Instead, we propose to combine the Chang–Cooper method with unconditionally positive Patankar-type time integration methods. In contrast to the implicit Euler method, these methods are only linearly implicit and also higher order accurate. We describe the combined approach, analyze it, and present some relevant numerical examples demonstrating advantages compared to schemes proposed in the literature.