

# Optimized flow for generalized Lefschetz thimble method

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Generalized thimble method is one of powerful methods to overcome the sign problem in numerical simulations. We point out that the method has a subtle property when applied to a nearly continuum system. The point is that solutions of the flow equation generically show exponential behavior, and the growing rates largely differ depending on the modes. It implies the ranges of the flow time where we resolve the sign problem and the Ergodicity problem are largely different mode by mode. It can lead to a great inefficiency in the simulation, in particular where we move the sampling point on the original contour. In order to deal with the subtlety, we propose the modified flow equation which preserves the properties of the original one and nevertheless normalizes the growing rates. As a demonstration, we reproduce the real-time evolution of an anharmonic oscillator with the modified flow, where it is difficult to perform the simulation with the original one.

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