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A Study of Numerical Reaction-Diffusion Systems on Closed Surfaces

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Abstract : The diffusion-reaction equations are important Partial Differential Equations in mathematical biology, material science, physics, and so on. However, finding efficient numerical methods for diffusion-reaction systems on curved surfaces is still an important and difficult problem. The purpose of this paper is to present a convergent geometric method for solving the reaction-diffusion equations on closed surfaces by an O(r)-LTL configuration method. The O(r)-LTL configuration method combining the local tangential lifting technique and configuration equations is an effective method to estimate differential quantities on curved surfaces. Since estimating the Laplace-Beltrami operator is an important task for solving the reaction-diffusion equations on surfaces, we use the local tangential lifting method and a generalized finite difference method to approximate the Laplace-Beltrami operators and we solve this reaction-diffusion system on closed surfaces. Our method is not only conceptually simple, but also easy to implement.

Keywords : closed surfaces, high-order approachs, numerical solutions, reaction-diffusion systems
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