Numerical simulation of ACRT with a Fourier-Legendre spectral element method

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A new Fourier-Legendre spectral element method （SEM） based on the Galerkin formulation is proposed in polar coordinates. The 1/r singularity at r=0 is avoided by using Gauss-Radau type quadrature points for the element involving the origin, and Gauss-Lobatto points are adopted for other elements in radial direction. In order to break the time-step restriction in the time-dependent problems, the clustering of collocation points near the pole is prevented through the technique of domain decomposition in the radial direction. By applying our proposed numerical isotope model, the SEM exhibites an obvious advantage to achieve the high accuracy solution with even fewer nodes, a long plagued problem, false numerical diffusion in numerical simulation, is obviously alleviated by using the Fourier-Legendre spectral element method. The accelerated crucible rotation technique (ACRT), a stirring technique, is conceived to alleviate the striation and is commonly used in solution crystal growth. The effect of ACRT on the concentration homogenization in high-temperature solution crystal growth method is investigated by the Fourier-Legendre spectral element method. The time splitting method is used for temporal discretization. Six typical ACRT modes are simulated, and the standard derivation is adopted to evaluate the homogeneous level of solution concentration. As a result, the optimum ACRT mode and time period are suggested.