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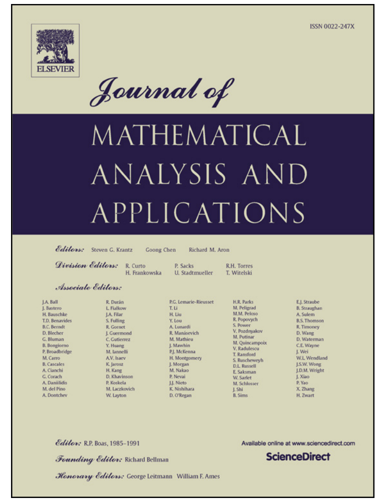

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Repulsion effects on boundedness in the higher dimensional fully parabolic attraction–repulsion chemotaxis system

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Abstract

This paper deals with an attraction–repulsion chemotaxis system

$$\begin{cases} u_t = \nabla\cdot(D(u)\nabla u) - \chi\nabla\cdot(u\nabla v) + \xi\nabla\cdot(u\nabla w), & x\in\Omega,\ t>0,\\ \tau_1 v_t = \Delta v + \alpha u - \beta v, & x\in\Omega,\ t>0,\\ \tau_2 w_t = \Delta w + \gamma u - \delta w, & x\in\Omega,\ t>0 \end{cases}$$

under homogeneous Neumann boundary conditions in a smooth bounded domain $\Omega \subset \mathbb{R}^N$ $(N \geq 2)$, where parameters $\tau_i (i = 1, 2)$, χ, ξ, α, β, γ and δ are positive, and diffusion coefficient $D(u) \in C^2(0, +\infty)$ satisfies $D(u) > 0$ for $u \geq 0$, $D(u) \geq du^{m-1}$ with $d > 0$ and $m \geq 1$ for all $u > 0$. It is proved that the corresponding initial–boundary value problem possesses a unique global bounded classical solution for $m > 2 - \frac{2}{N}$. In particular in the case $\tau_1 = \tau_2$ and $\chi\alpha = \xi\gamma$, the solution is globally bounded if $m > 2 - \frac{2}{N} - \frac{N+2}{N^2-N+2}$. Therefore, due to the inhibition of repulsion to the attraction, the range of $m > 2 - \frac{2}{N}$ of boundedness is enlarged and the results of [21] is thus extended to the higher dimensional attraction–repulsion chemotaxis system with nonlinear diffusion.

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