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Traveling wave solution for a flux limited reaction-diffusion equation

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Reaction-diffusion equations can describe a wide range of transport processes in physical, chemical and biological systems. The solutions of this equations predict that the particle or population density evolves as the traveling wave with unlimited constant speed. As we know, the speed of sound is highest admissible value in a medium. However, this property is lost in the conventional reaction-diffusion equations. The flux limited reaction-diffusion equation is the new proposed model for removing this shortcoming. Unfortunately, the complete solution to this equation has not been well understood due to its complexity. In this research, we studied a flux limited reaction-diffusion model that is a variance form of the Fisher-Kolmogorov–Petrovsky–Piskunov (Fisher-KPP) equation. We found its analytical traveling solution in approximate form by using a perturbation method. We also solved the full equation by using an implicit finite-difference method for comparing with the analytical solution. The solutions of this equation, both analytically and numerically, could reveal more realistic physical properties of the reaction-diffusion model.

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