

Speeds of Spread and Propagation for KPP Models in Time almost and Space Periodic Media

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Abstract. The current paper is devoted to the study of spatial spreading and front propagating dynamics of KPP models in inhomogeneous media, in particular, in time almost periodic and space periodic media. While spatial spreading and front propagating dynamics of KPP models in time independent or periodic media has been widely studied, there is little study on such dynamics when the media is non-periodically inhomogeneous. This paper develops some theoretical foundation for the study of the speeds of spread and propagation for KPP models in time almost periodic and space periodic media. It introduces a notion of spreading speed intervals for such models for the first time, which extends the classical concept of the spreading speeds for time independent or periodic KPP models to time almost periodic ones and can be used for more general time dependent ones. It also introduces a notion of generalized propagating speed intervals of solutions and a notion of generalized wave solutions to time almost periodic and space periodic KPP models for the first time, which are the generalizations of wave speeds and traveling wave solutions to time independent or periodic KPP models. It proves various fundamental properties of the spreading speed intervals, including the boundedness, recovery of the classical spreading speed when the model is time periodic, minimality, and natural spatial spread properties. It also provides some upper and lower bounds for spreading and generalized propagating speeds.

Key words. Almost periodic KPP model, spreading speed interval, generalized propagating speed interval, generalized wave solution, traveling wave solution, principal eigenvalue, principal Lyapunov exponent.

Mathematics subject classification. 35K55, 35K57, 35B15, 92D25.