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Spike distribution density in a reaction-diffusion system with spatial dependence

We consider a standard reaction-diffusion system (the Schnakenberg model) that generates localized spike patterns. Our goal is to characterize the distribution of spikes and their heights in the limit of many spikes, in the presence of spatially-dependent feed rate $A(x)$. This leads to an unusual nonlocal problem for spike locations and their heights. A key feature of the resulting nonlocal problem is that it is necessary to estimate the difference between the continuum limit and the discrete algebraic system to derive the effective spike density. In a certain limit, we find that the effective spike density scales like $A^{2/3}(x)$ whereas the spike heights scale like $A^{1/3}(x)$. In another limit, we derive instability thresholds for when N spikes become unstable.