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Stripe patterns for Gierer-Meinhard model in thin domains

We expore pattern formation for the GM model on thin domains. A motivating example is the development bone structure within the embryonic eye of birds. Experimental evidence to-date points to a Turing mechanism of pattern formation on thin domains.

If the domain is sufficiently thin, the pattern consists of stripes which are nearly one-dimensional. We analyse patterns consisting of one, two or many stripes. We find that a single stripe can be located either at the thickest or thinnest part of the channel, depending on the choice of parameters. In the limit of many stripes, we derive an effective pattern density description of the equilibrium state. The effective density is easily computable as a solution of a first order ODE subject to an integral constraint. Depending on problem parameters, the resulting pattern can be either global spanning the entire domain, or can be clustered near either thickest or thinnest part of the domain. In addition, instability thresholds are derived from the continuum density limit of many stripes. Full two-dimensional numerical simulations are performed and are shown to be in agreement with the asymptotic results. Results are shown to be applicable to