# Ex - Problem Set 2 - Task 2

Friday, February 17, 2023 3:12 PM

$$\frac{\partial u}{\partial t} = f(u,v) + D_u \nabla^2 u$$

$$\frac{\partial v}{\partial t} = g(u,v) + D_v \nabla^2 v$$

b) Lecture notes 7.3

① Find stable steady state(s) where no diffusion

② Consider spacio-temporal pert.

$$\vec{n} = \vec{n}^* + \delta\vec{n}(\vec{r},t)$$

Linearize equation, 2nd order negligeble

③ Insert expression in original expression,

keep 1st order $\delta n$ terms

④ obtain diff eq. with solution

$$\delta\vec{n}(\vec{r},t) = T(t)\,R(\vec{r})\,\delta n_0, \quad \delta n_0 = \text{const}$$

⑤ $\delta\vec{n}(\vec{r},t) \sim e^{\lambda t + i\vec{k}\vec{r}}$

$\lambda > 0$, pertubation grows over time

$$\lambda\,\delta n_0 = \left[J(\vec{n}^*) - k^2 \mathbb{D}\right]\delta\vec{n}_0$$

find at least one positive eigenvalue

condition:

let $d = \frac{D_v}{D_u}$

$$dJ_{11} + J_{12} > 0$$

$$(dJ_{11} + J_{22})^2 - 4d \det J > 0$$

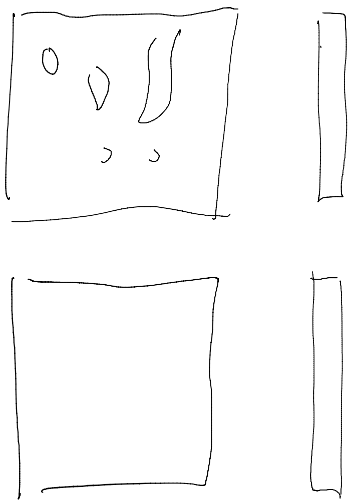
c) Simulation

Laplacian:

$$\nabla^2 u = \frac{u(x+h,y,t) + u(x-h,y,t) + u(x,y+h,t) + u(x,y-h,t) - 4u(x,y,t)}{h^2}$$

Boundary:

- use modulus



use same color map, ensure same scale