

## Python 08 Challenge!

Consider the one-dimensional Gray–Scott equations:

$$\begin{aligned}u_t &= \epsilon_u \Delta u - uv^2 + F(1 - u) \\v_t &= \epsilon_v \Delta v + uv^2 - (c + F)v\end{aligned}$$

with homogeneous Dirichlet boundary conditions on  $[-1, 1)$ .

- (a) Solve the zero-diffusion case with  $c = 0.065$ ,  $F = 0.06$  with forward Euler, for various initial conditions. Plot the steady-state solutions.
- (b) Take  $\epsilon_u = 6 \times 10^{-5}$ ,  $\epsilon_v = 2 \times 10^{-5}$ . Use the initial condition

$$\begin{aligned}v(x) &= \chi(x) + 0.05\eta(x) \\u(x) &= 1 - v(x)\end{aligned}$$

where  $\eta(x) \sim \mathcal{N}(0, 1)$  and

$$\chi(x) = \begin{cases} 1 & \text{if } |x - 0.1| \leq 0.1 \\ 0 & \text{otherwise} \end{cases}$$