$$u_t + a u_x = \varepsilon u_{xx}$$

Advection–diffusion equation

Suppose: $u(x,t) = \hat{u}(t) e^{i\xi x}$

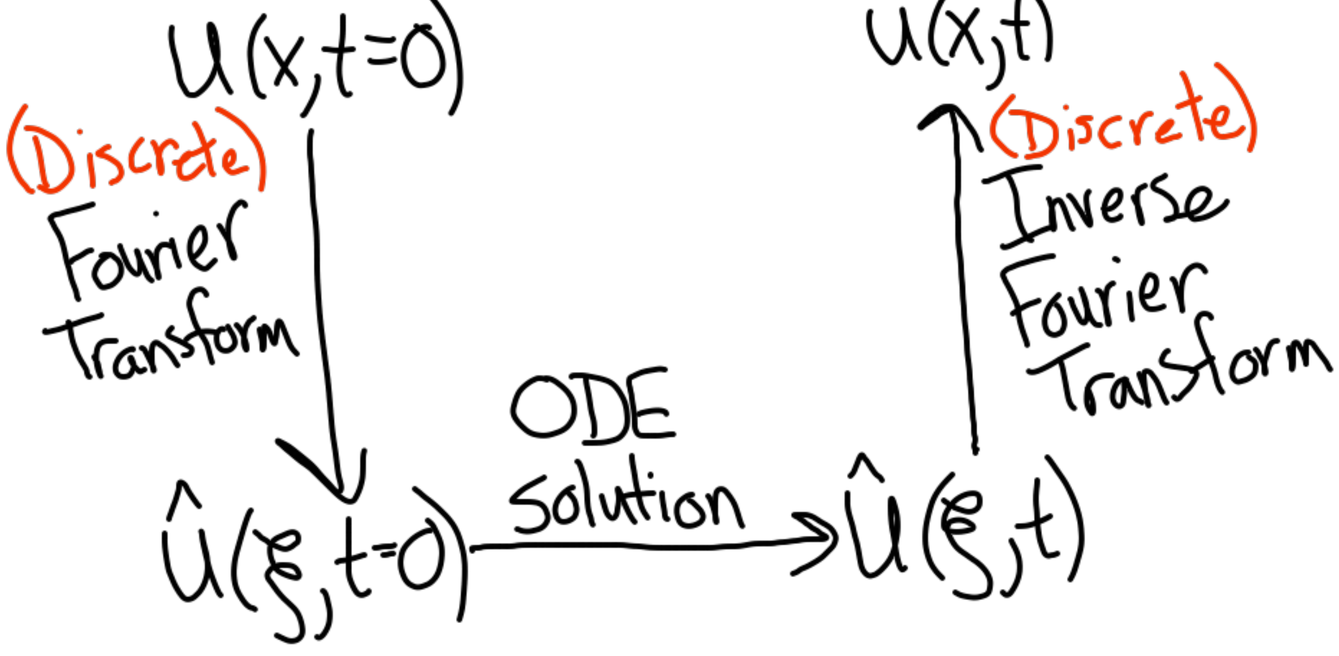
ξ: wavenumber

$$\hat{u}'(t) e^{i\xi x} + a i\xi \hat{u} e^{i\xi x} = -\varepsilon \xi^2 \hat{u} e^{i\xi x}$$

$$\hat{u}'(t) = (-ia\xi - \varepsilon\xi^2)\hat{u}(t)$$

$$\hat{u}(t) = \exp\left(-t(ia\xi + \varepsilon\xi^2)\right)\hat{u}(0)$$

Fourier Solution of a linear PDE



$$D[V] = \begin{bmatrix} V_1 & & & \\ & V_2 & & \\ & & \ddots & \\ & & & V_m \end{bmatrix}$$