

Weekly objective

$$i\partial_\xi F = \underbrace{-i\beta_1 \partial_T F}_{\text{mobility}} + \frac{\beta_2}{z} \partial_\tau^2 F$$

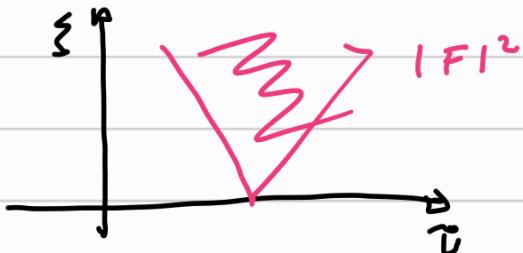
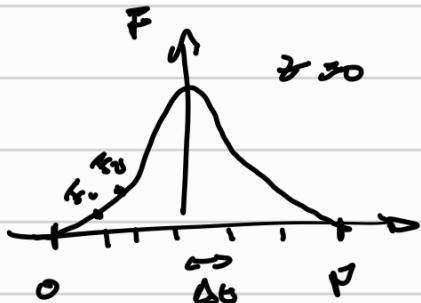
Brownie points

$$U_F = F$$

reformulating notation according to solitons paper

$$\begin{aligned} i\partial_z F_f + \left( i\bar{\beta}_f^{(1)} \partial_t - \frac{1}{2} \bar{\beta}_f^{(2)} \partial_\tau^2 \right) F_f + \gamma F_f^* (F_{s1} + \alpha F_{s2}) &= 0, \\ i\partial_z F_{s1} + (\kappa - i\bar{\beta}_s^{(1)} \partial_t) F_{s1} + C F_{s2} + \frac{\gamma}{2} F_f^2 &= 0, \\ i\partial_z F_{s2} + (\kappa + i\bar{\beta}_s^{(1)} \partial_t) F_{s2} + C F_{s1} + \frac{\gamma \alpha}{2} F_f^2 &= 0. \end{aligned} \quad (5)$$

$$F(\xi, \tau) \text{ for } i\partial_\xi F = \frac{\beta_2}{z} \partial_\tau^2 F - i\beta_1 \partial_T F \quad \text{"mobility"}$$



$$BC = 0$$

Solving tech



Basis set

~ Spectral

$$i\partial_\xi F_j = -\frac{\beta_2}{\Delta t^2} (F_{j+1} + F_{j-1} - 2F_j)$$

$$F_\xi = \sum c_n(\xi) e^{-in\omega_0 \xi}$$

$\omega_0 = \frac{2\pi}{N \cdot \Delta t}$

FFT  
IFFT

$$k = \frac{\beta_2}{z} \omega^2$$

$$\frac{1}{V_0} = \frac{\partial k}{\partial \omega} = \beta_2 \omega$$

$$i\partial_\xi c_n = \frac{\beta_2}{2} (-n\omega_0)^2 c_n$$

$$v_g = \frac{\partial \omega}{\partial k}$$

$$\beta_2 = \frac{\partial \beta}{\partial \omega} \text{ as } \beta(\omega) \approx \beta_0 + \beta_1 \omega + \frac{\beta_2}{2} \omega^2 + \dots$$

① FDM

$$i\partial_\xi F_j = -\frac{\beta_2}{\Delta t^2} (F_{j+1} + F_{j-1} - 2F_j)$$

② Basis set

explict-explicit

① FDM

$$i\partial_\xi F_j = -\frac{\beta_2}{\Delta t^2} (F_{j+1} + F_{j-1} - 2F_j)$$

② Basis set

$$F_j = \sum g_m e^{im\omega_0 \xi}$$

Diagram of a finite difference stencil for the second derivative operator  $\frac{\partial^2}{\Delta x^2}$ . It shows a central node  $i$  with neighbors  $i+1$ ,  $i-1$ ,  $i+2$ , and  $i-2$ . The formula is  $\frac{\partial^2}{\Delta x^2} F_j = -\frac{r_2}{\Delta x^2} (F_{j+1} + F_{j-1} - 2F_j)$ .

$$\frac{\partial^2}{\Delta x^2} F_j = -\frac{r_2}{\Delta x^2} (F_{j+1} + F_{j-1} - 2F_j)$$

$$C_n(0) = \sum c_n(k) \exp(i k \omega_0 \tau)$$

$$i \partial_z C_n = -r_2 (-n \omega_0)^2 C_n$$

$$C_n(z) = C_n(0) \exp(-i r_2 n^2 \omega_0^2 z)$$

(1) FDM

$$i \partial_z^2 F_j = -\frac{r_2}{\Delta x^2} (F_{j+1} + F_{j-1} - 2F_j)$$

(2) Basis-set (spectral)

$$F_z = \sum c_n(k) \exp(i k \omega_0 \tau)$$

$$\omega_0 = \frac{2\pi}{N \cdot \Delta t}$$

$$i \partial_z C_n = -r_2 (-n \omega_0)^2 C_n$$

$$C_n(z) = C_n(0) \exp(-i r_2 n^2 \omega_0^2 z)$$

(1) FDM

$$i \partial_z^2 F = \frac{r_2}{2} \partial_x^2 F$$

$$i \partial_z^2 F_j = -\frac{r_2}{\Delta x^2} (F_{j+1} + F_{j-1} - 2F_j)$$

(2) Basis-set (spectral)

$$F(z, \tau) = \sum c_n(k) \exp(i k \omega_0 \tau)$$

$$\omega_0 = \frac{2\pi}{N \cdot \Delta t}$$

$$i \partial_z C_n = -\frac{r_2}{2} (-n \omega_0)^2 C_n$$

$$C_n(z) = C_n(0) \exp(-i \frac{r_2}{2} n^2 \omega_0^2 z)$$

Diagram showing a wavy function  $F$  plotted against  $x$  and  $z$ . A Fourier transform  $F_z$  is shown with a peak at  $k=0$ . The frequency  $\omega_0$  is related to the wave number  $k$  by  $\omega_0 = \frac{\partial \omega}{\partial k}$ . The dispersion relation is  $\frac{1}{v_0} = \frac{\partial k}{\partial \omega}$ . The ratio  $\left(\frac{r_2}{T_0}\right)^{-1} = L_d$  is also shown.

(1) FDM

$$i \partial_z^2 F = \frac{r_2}{2} \partial_x^2 F$$

$$i \partial_z^2 F_j = -\frac{r_2}{\Delta x^2} (F_{j+1} + F_{j-1} - 2F_j)$$

(2) Basis-set (spectral)

$$F(z, \tau) = \sum c_n(k) \exp(i k \omega_0 \tau)$$

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