13.

a). $u_{tt} = A_1 e^{\sigma_1 t} \sin[k_1 \tilde{\nu}(x-at) + \beta_1 t] + A_2 e^{\sigma_2 t} \sin[k_2 \tilde{\nu}(x-at) + \beta_2 t]$

$= u_1 + u_2$

$u_t + a u_x \approx -a \cdot \frac{(\Delta x)^2}{6}[1-C^2] u_{xxx} - \frac{a(\Delta x)^3}{8} C(1-C^2) u_{xxxx}$

b_3 b_4

for u_1

$u_t = A_1 e^{\sigma_1 t} \cdot \sigma_1 \cdot \sin[k_1 \tilde{\nu}(x-at) + \beta_1 t]$

$+ A_1 e^{\sigma_1 t} \cdot \cos[k_1 \tilde{\nu}(x-at) + \beta_1 t] \cdot (-k_1 \tilde{\nu} a + \beta_1)$

$u_x = A_1 e^{\sigma_1 t} \cdot \cos[k_1 \tilde{\nu}(x-at) + \beta_1 t] \cdot k_1 \tilde{\nu}$

$u_{xxx} = A_1 e^{\sigma_1 t} \cdot (-1) \cdot \cos[k_1 \tilde{\nu}(x-at) + \beta_1 t] \cdot (k_1 \tilde{\nu})^3$

$u_{xxxx} = A_1 e^{\sigma_1 t} \cdot (-1)^2 \cdot \sin[k_1 \tilde{\nu}(x-at) + \beta_1 t] \cdot (k_1 \tilde{\nu})^4$

substitute Let $w = k_1 \tilde{\nu}(x-at) + \beta_1 t$

$\sigma_1 \sin w + \cos w \cdot (-k_1 \tilde{\nu} a + \beta_1) + \cos w \cdot k_1 \tilde{\nu}$

$=$

$+a \cdot \frac{(\Delta x)^2}{6}[1-C^2] \cos w \cdot (k_1 \tilde{\nu})^3 - \frac{a(\Delta x)^3}{8} C \cdot (1-C^2) \cdot \sin w \cdot (k_1 \tilde{\nu})^4$

$\sin w \left(\sigma_1 + \frac{a(\Delta x)^3}{8} \cdot (k_1 \tilde{\nu})^4\right) + \cos w \left(-k_1 \tilde{\nu} a + \beta_1 + k_1 \tilde{\nu} - a \cdot \frac{(\Delta x)^2}{6} \cdot (1-C^2) \cdot (k_1 \tilde{\nu})^3\right]$

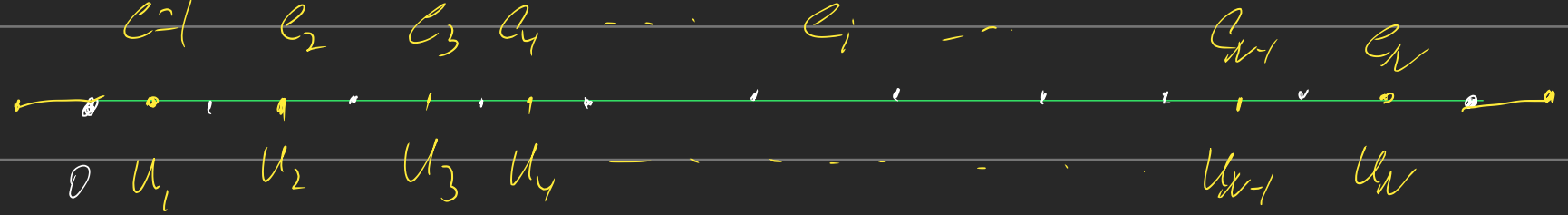
$=$

0

$$\sigma_1 = b_4 (k_1 \tau_0)^4$$

$$R_1 = k_1 \tau_0 a - k_1 \tau_0 - b_3 \cdot (k_1 \tau_0)^3$$

$$b_3 =$$



$$\frac{a \Delta t}{\Delta x} = c_i L \qquad \Delta t = \frac{c_i L \cdot \Delta x}{a}$$

$$u_j^{n+1} = u_j^n - \frac{a \Delta t}{2 \Delta x}\left[u_{j+1}^n - u_{j-1}^n \right] + \frac{1}{2}\left(\frac{a \Delta t}{\Delta x}\right)^2 \left(u_{j+1}^n - 2u_j^n + u_{j-1}^n \right)$$

$$= u_j^n \left(1 - c^2\right) + u_{j+1}^n \left(-\frac{1}{2}c + \frac{1}{2}c^2 \right) + u_{j-1}^n \left(\frac{1}{2}c + \frac{1}{2}c^2 \right)$$