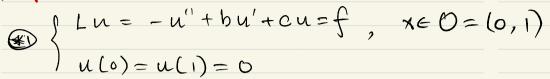
## Upwind Scheme

BVP



Asm OCZO, @ =! Smooth Solm

Goal O Implement CFD on &

2 Convergence rate

Recall CFD of ( is where  $Y_{\hat{i}} = \frac{1}{h^2} + \frac{b\hat{i}}{2h}$  $S_i = \frac{2}{h^2} + G_i$  $4i = \frac{1}{h^2} - \frac{bi}{2h}$ Convergence rate

1111h'-Rhullo 5 Kh²

UFD: Basic Idea

$$u'' \leftarrow \delta_n \delta_{-n} u$$
 $u' \leftarrow \delta_n u$  for eto

 $u' \leftarrow \delta_n u$ , if  $b(x) < 0$ 
 $\delta_{-n} u$ , if  $b(x) \ge 0$ 
 $\delta_{-n} u = (b^{\dagger} - b^{\dagger}) u'$ 
 $\delta_{-n} u = b \delta_{n} u$ 
 $\delta_{-n} u = b \delta_{n} u$ 
 $\delta_{-n} u = \delta_{-n} u = \delta_{-n} u$ 

$$-\frac{u_{i+1}-2u_{i}+u_{i-1}}{h^{2}}+b^{+}\frac{u_{i}-u_{i-1}}{h}-b^{-}\frac{u_{i+1}-u_{i}}{h}+cu_{i}=f_{2}$$

$$-u_{i-1}\left(\frac{1}{h^{2}}+\frac{b^{+}}{h}\right)$$

$$+u_{i}\left(\frac{2}{h^{2}}+\frac{b^{+}}{h}+c\right)$$

$$-u_{i+1}\left(\frac{1}{h^{2}}+\frac{b^{-}}{h}\right)=f_{i}$$

thm UFD soln uh solves  $U_0^h = 0$  $Y_{i} = \frac{1}{h^2} + \frac{b^4}{h}$  $\frac{1}{h^2} + \frac{bi}{2h}$ S: = = = + bb + c  $\frac{2}{h^2} + C_i$ ti = 1 + 1

Convergence rate

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O UFD, ringsi,ti >0, CFP, ri, si, ti >0 only of his small @ so UFD has better stability B but convergence rates are the same (4) The proof are the same.