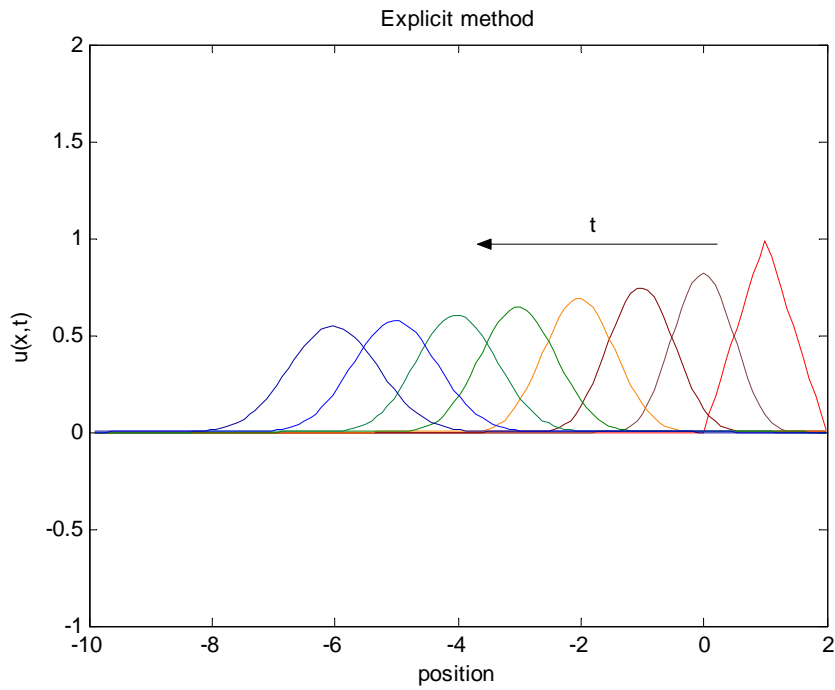


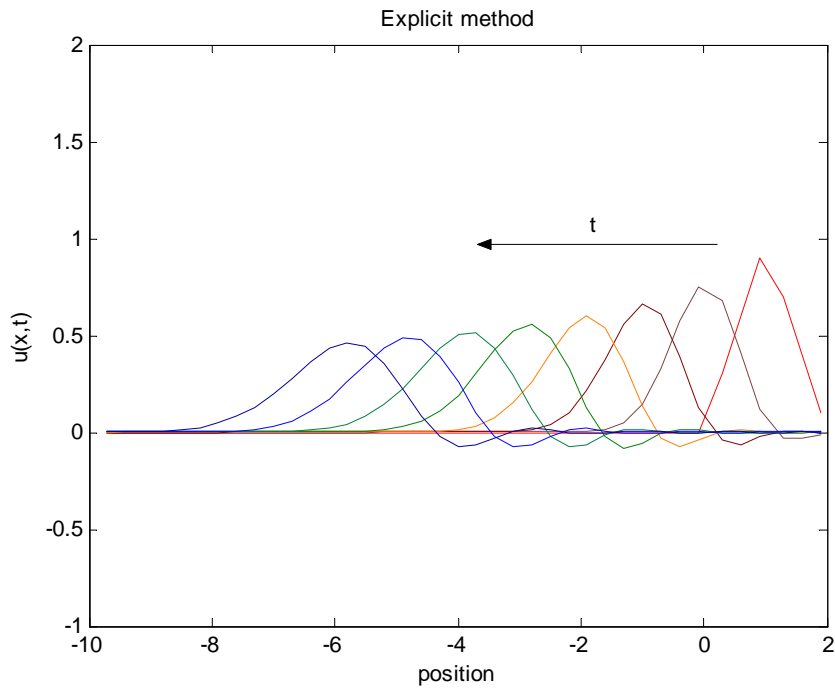
1. $u_t = cu_x + du_{xx}$ Convection-Diffusion equation (plot @t=1,2,3,...)

Explicit method (dt=0.05, c=1, d=0.05)

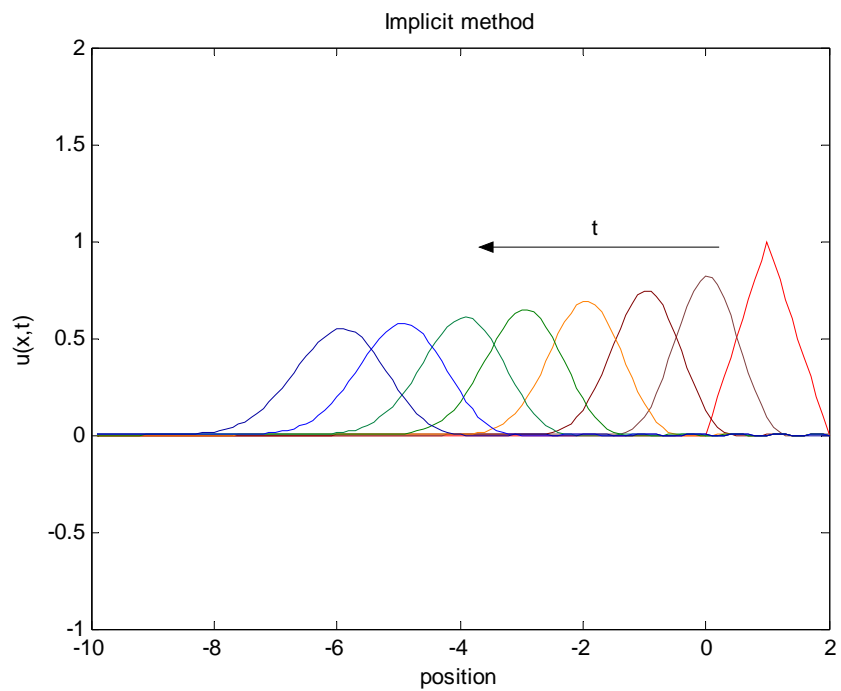
$P=0.9 < 1$ (dx=0.09, r=0.5556, R=0.3086)



$P=3 > 1$ (dx=0.3, r=0.1667, R=0.0278)



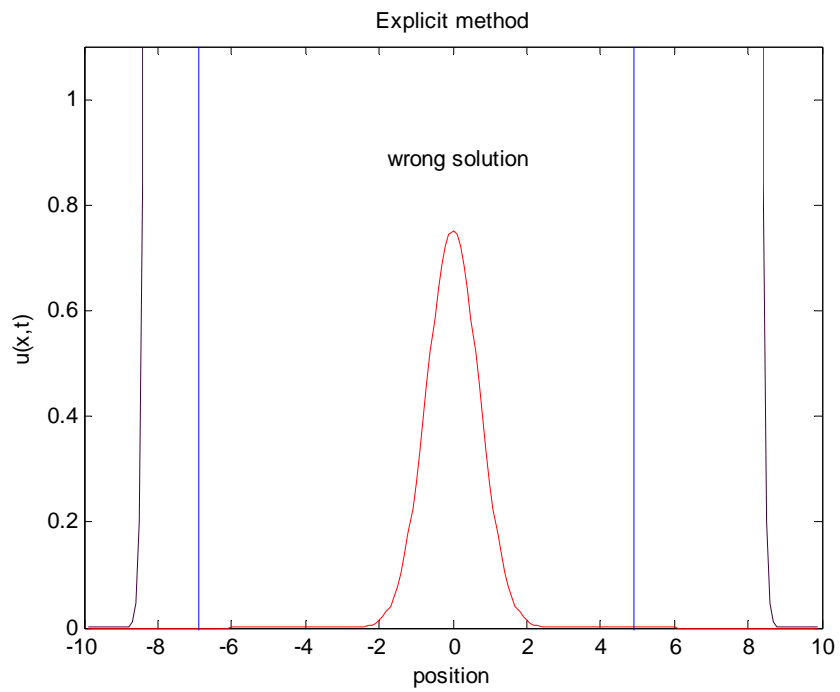
Implicit method ($dx=0.1$, $dt=0.05$, $c=1$, $d=0.05$)



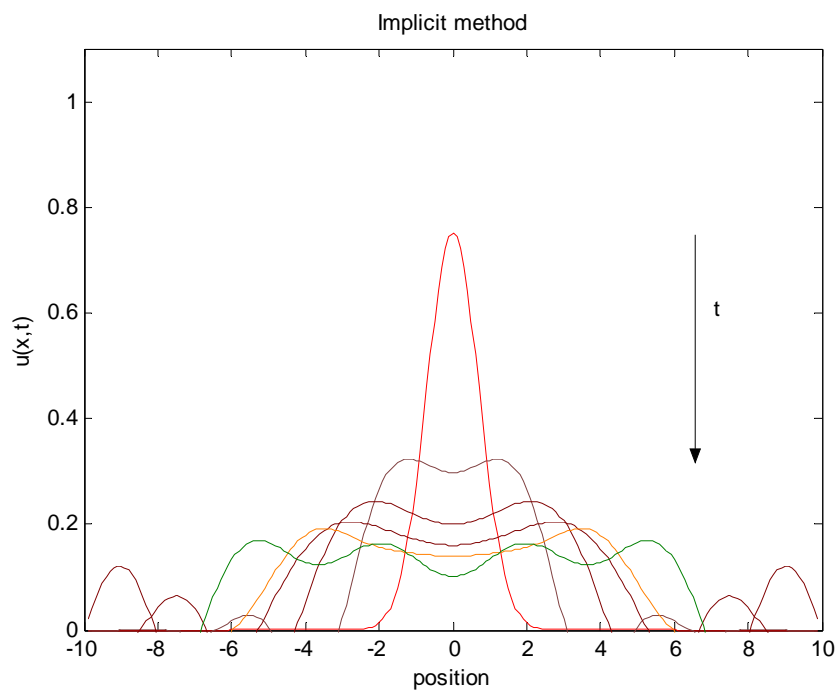
2. $u_t = iu_{xx}$ Schrödinger equation (plot @t=1,2,3,...)

dt=0.05, dx=0.1

Explicit method (unstable)



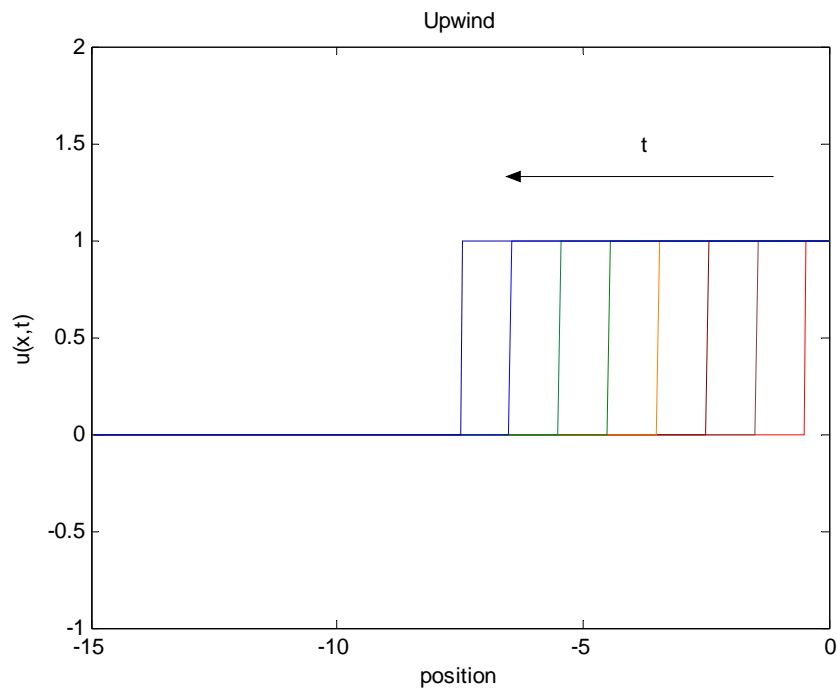
Implicit method



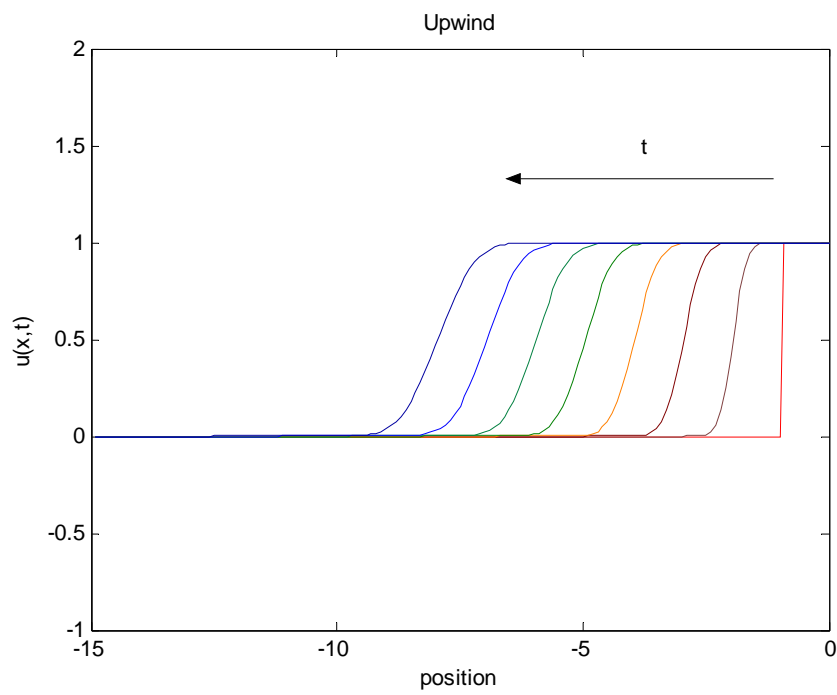
3. $u_t = u_x$ 1-way wave equation (plot @t=1,2,3,...)

Upwind method (dt=0.05)

r=1 (dx=0.05)

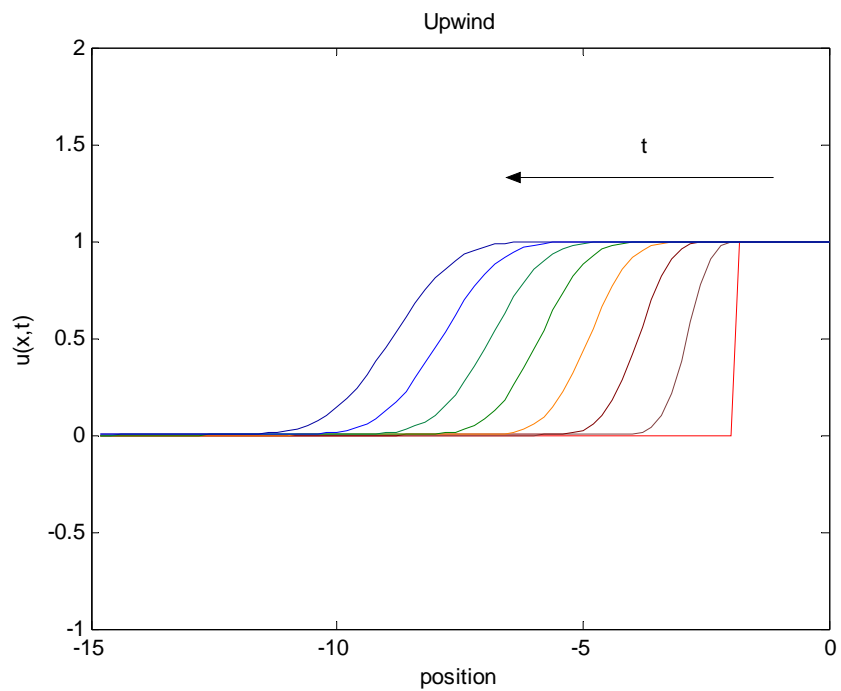


r=0.5 (dx=0.1)



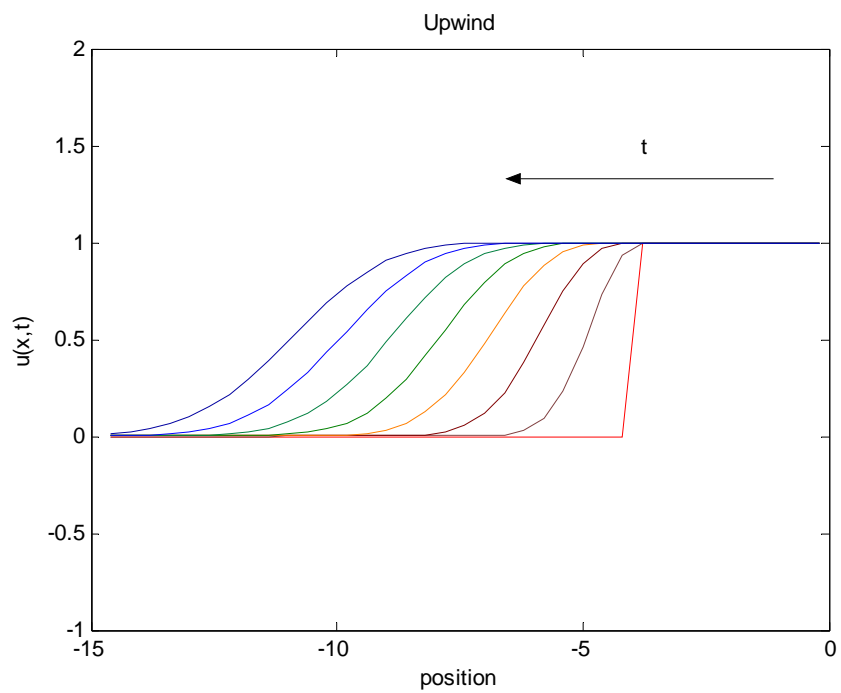
shock_width (wdx) : w= 7 9 11 13 13 15 17

$r=0.25$ ($dx=0.2$)



shock_width (wdx): w = 6 8 9 11 12 13 15

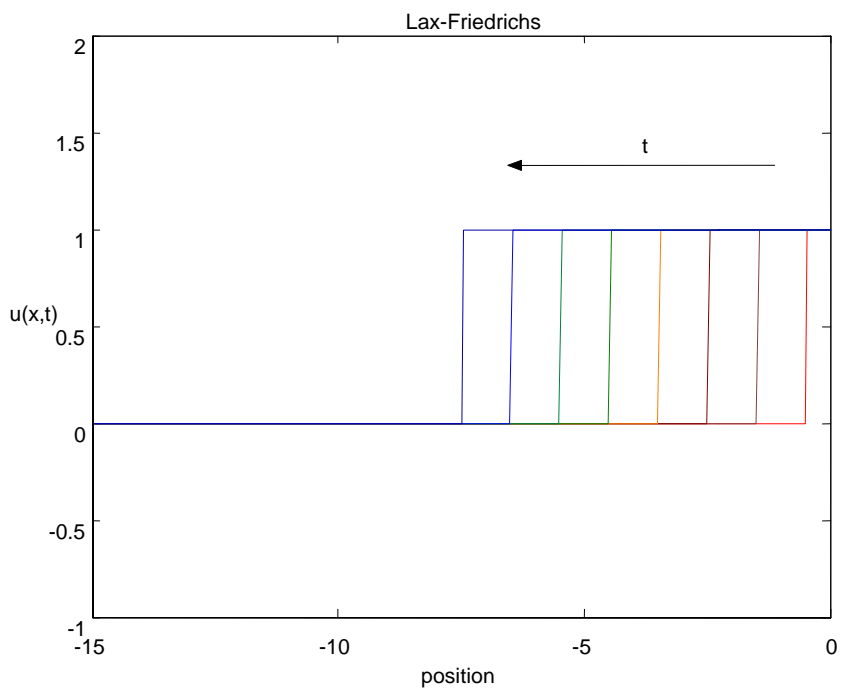
$r=0.125$ ($dx=0.4$)



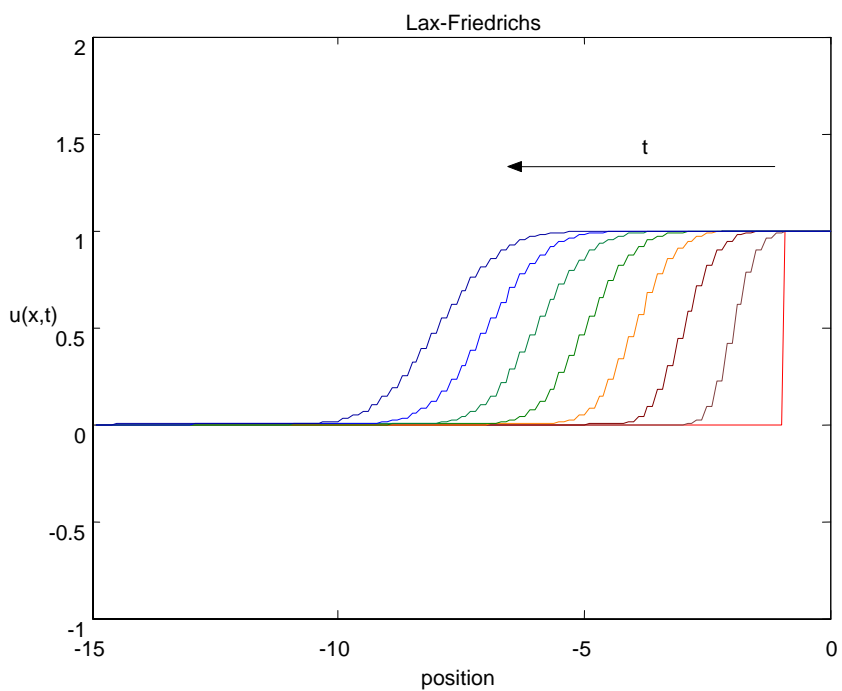
shock_width (wdx): w = 4 7 8 9 10 11 11

Lax-Friedrichs method ($dt=0.05$)

$r=1$ ($dx=0.05$)

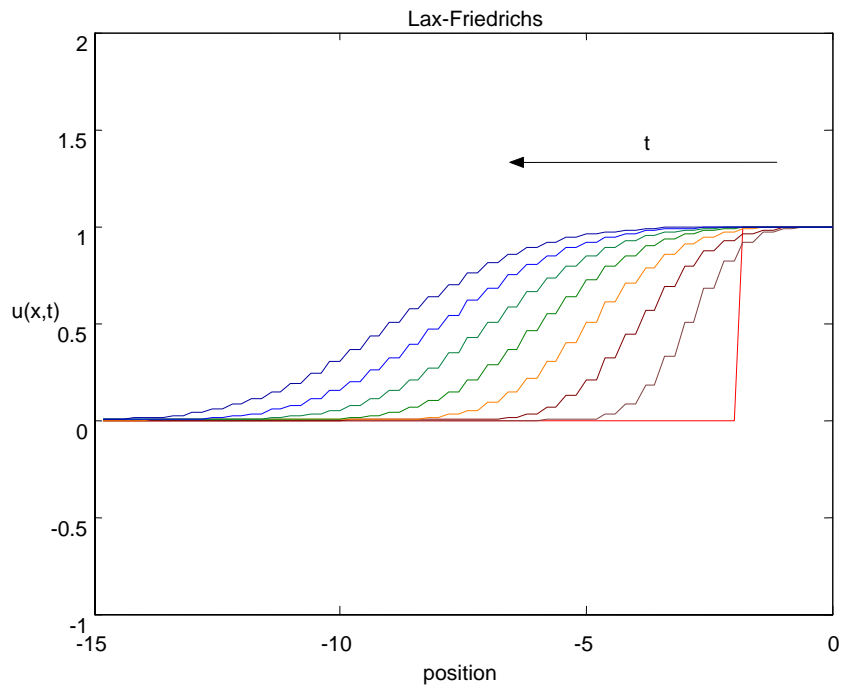


$r=0.5$ ($dx=0.1$)



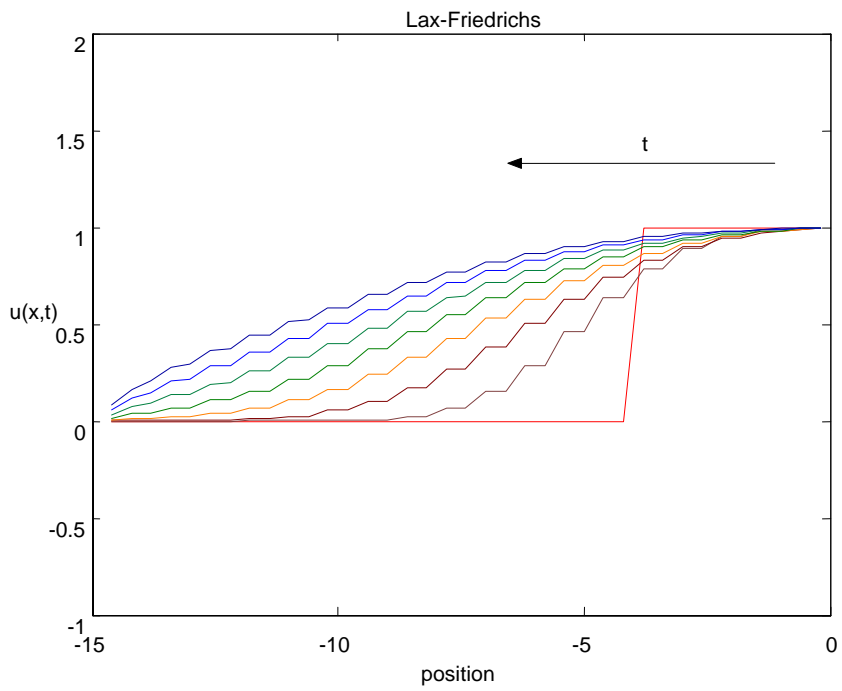
shock_width (wdx): dx = 11 15 17 21 23 25 29

r=0.25 (dx=0.2)



shock_width (wdx): w = 11 17 19 25 27 29 31

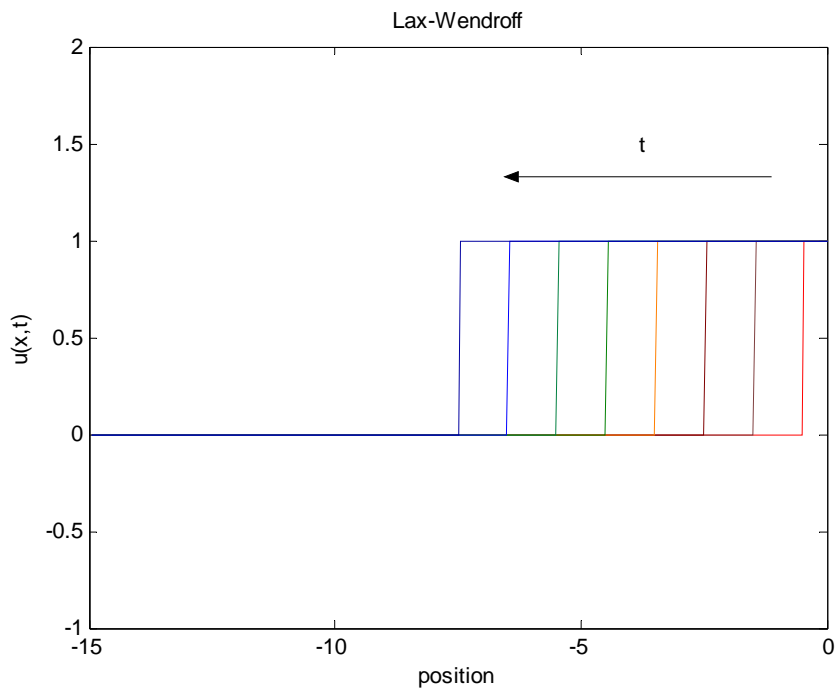
r=0.125 (dx=0.4)



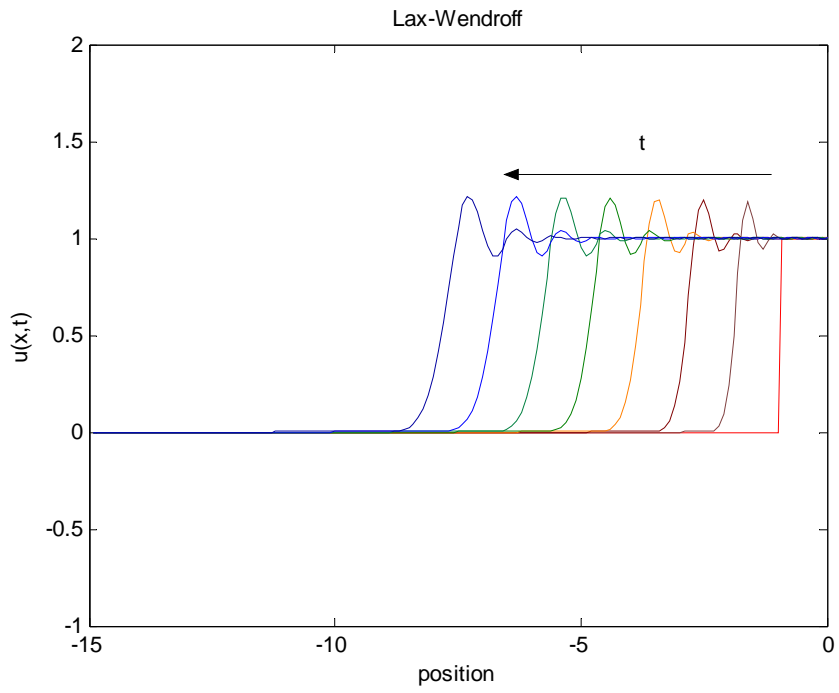
shock_width (wdx): w = 13 19 21 25 25 25 25

Lax-Wendroff method (dt=0.05)

r=1 (dx=0.05)

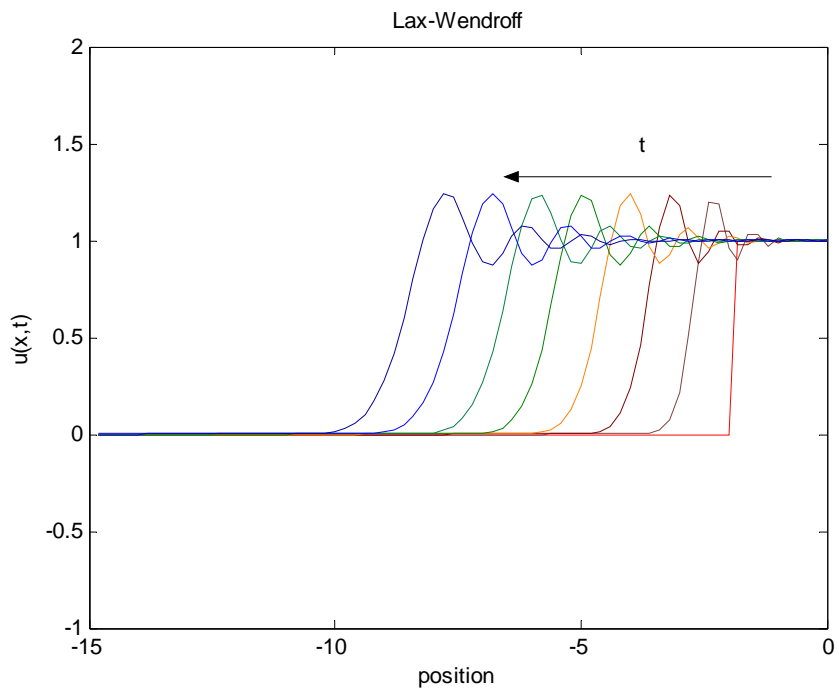


r=0.5 (dx=0.1)



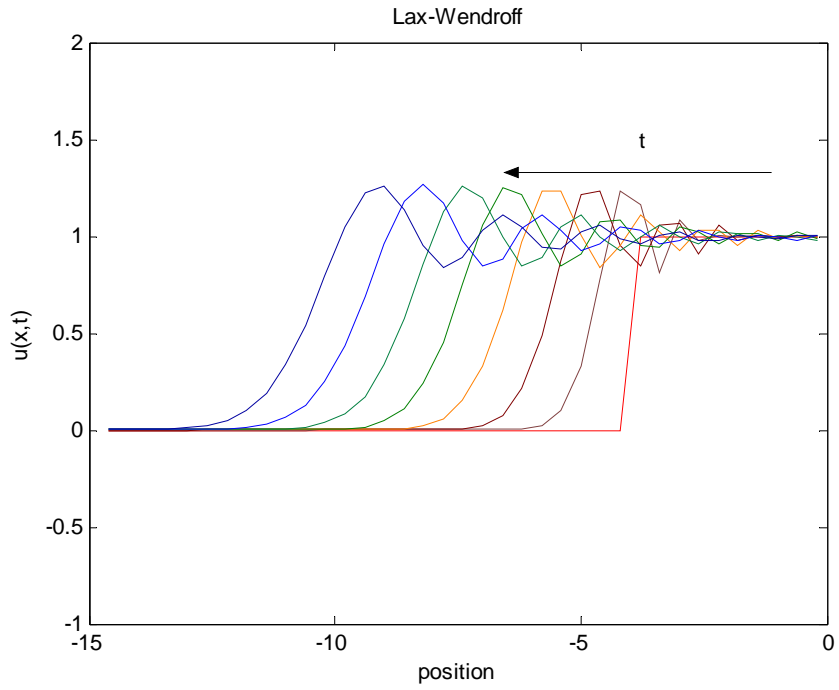
shock_width (wdx): w = 4 6 7 8 9 9 10

r=0.25 (dx=0.2)



shock_width (wdx): w = 4 5 6 7 7 8 8

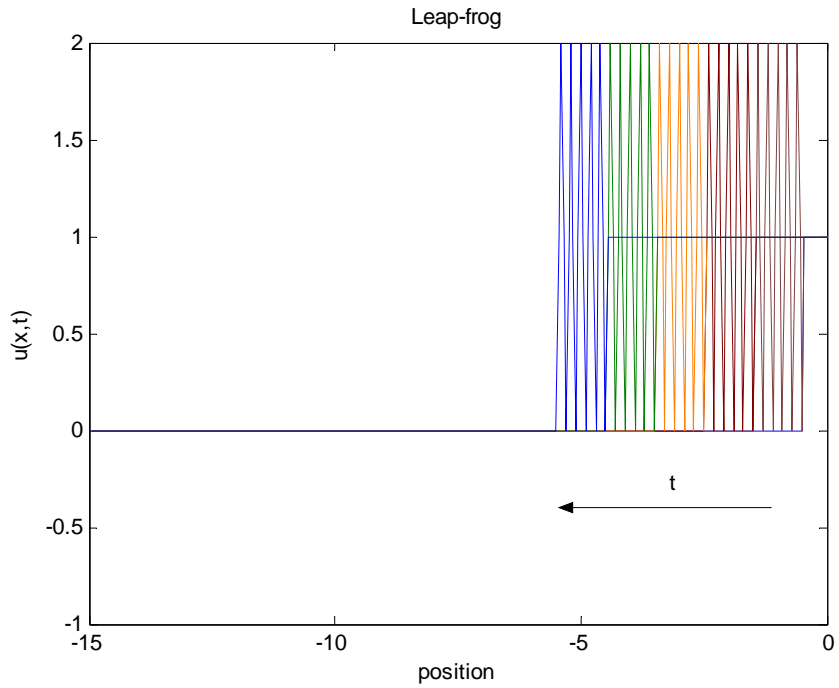
$r=0.125$ ($dx=0.4$)



shock_width (wdx): w = 3 4 5 5 6 7 6

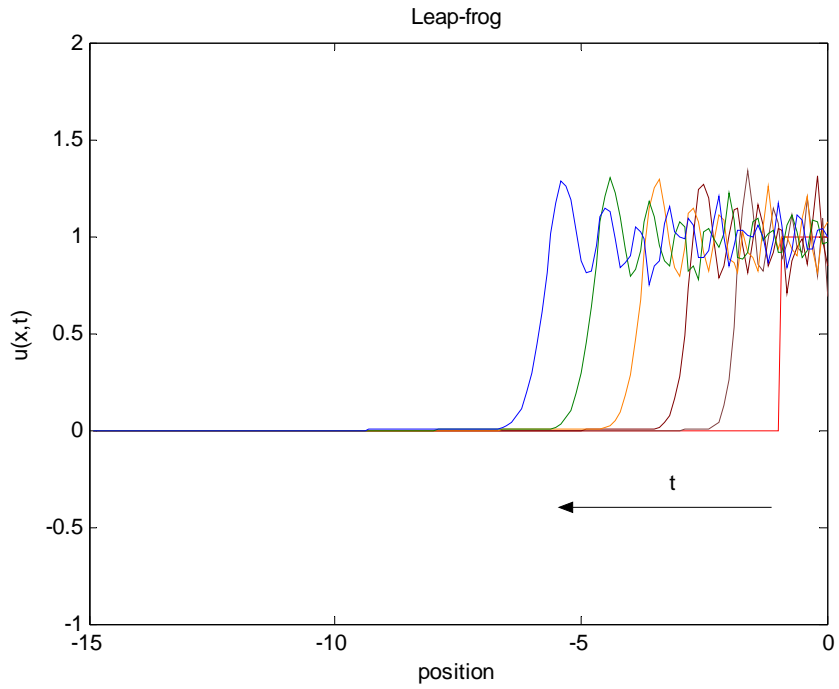
Leap-frog method ($dt=0.05$)

$r=1$ ($dx=0.05$)

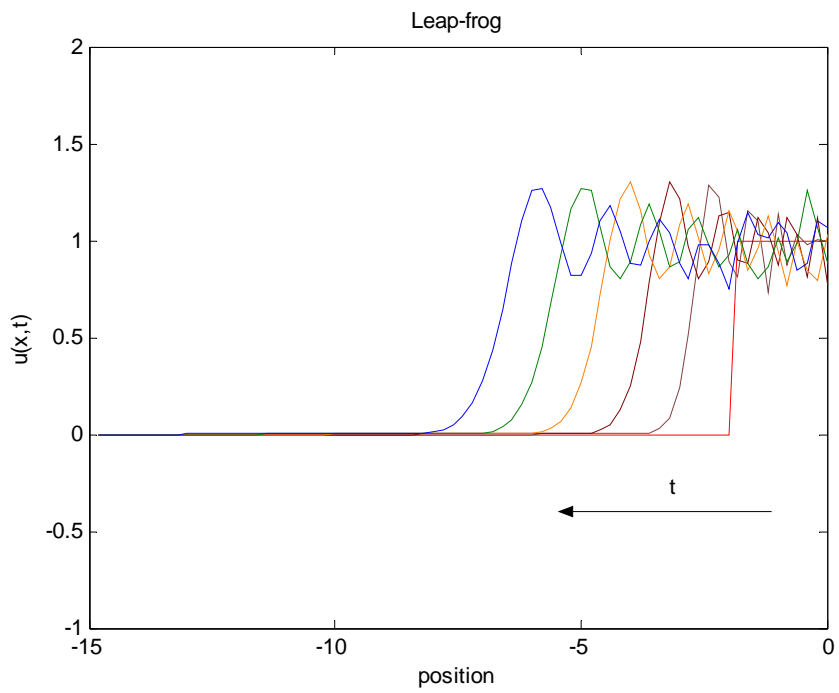


shock_width (wdx): w = 1 1 1 1 1

$r=0.5$ ($dx=0.1$)

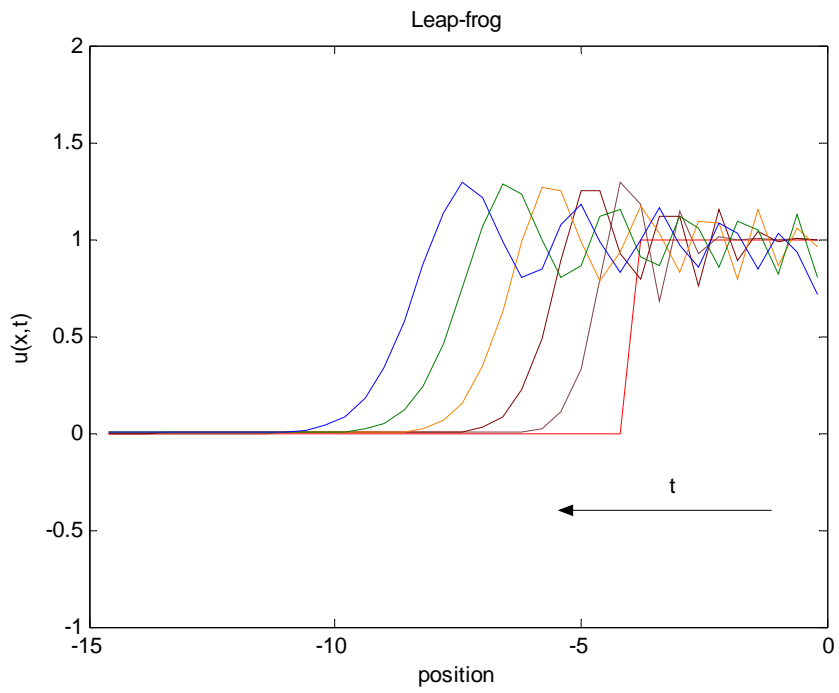


shock_width (wdx): w = 1 1 1 1 1
 $r=0.25$ ($dx=0.2$)



shock_width (wdx): w = 1 1 1 1 1

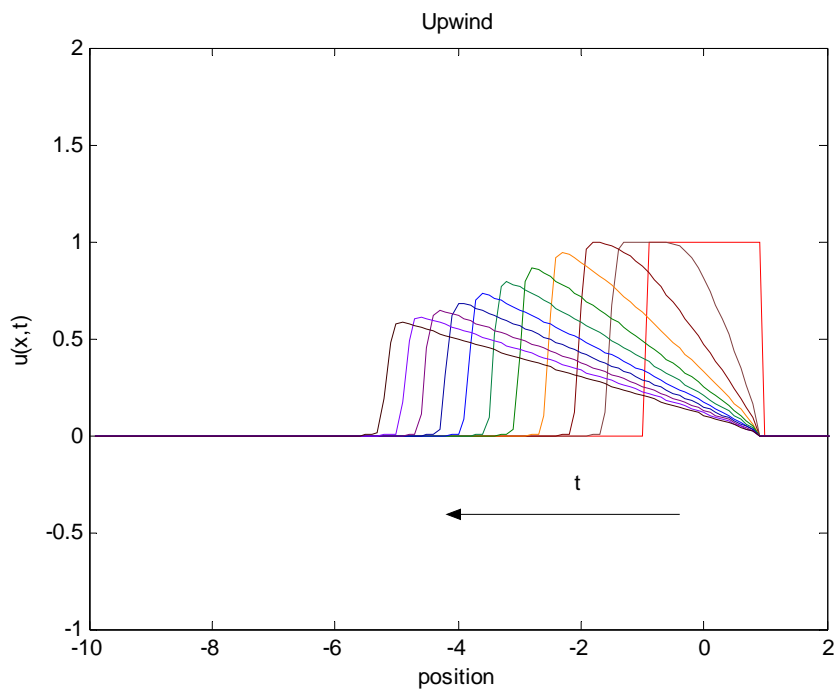
$r=0.125$ ($dx=0.4$)



shock_width (wdx): $w = 1 \quad 1 \quad 1 \quad 1 \quad 1$

4. $u_t = uu_x$ Conservation law (plot @ $t=1,2,3,\dots$)

Upwind method ($dx=0.1$, $dt=0.05$)



Lax-Wendroff method ($dx=0.1, dt=0.05$)

