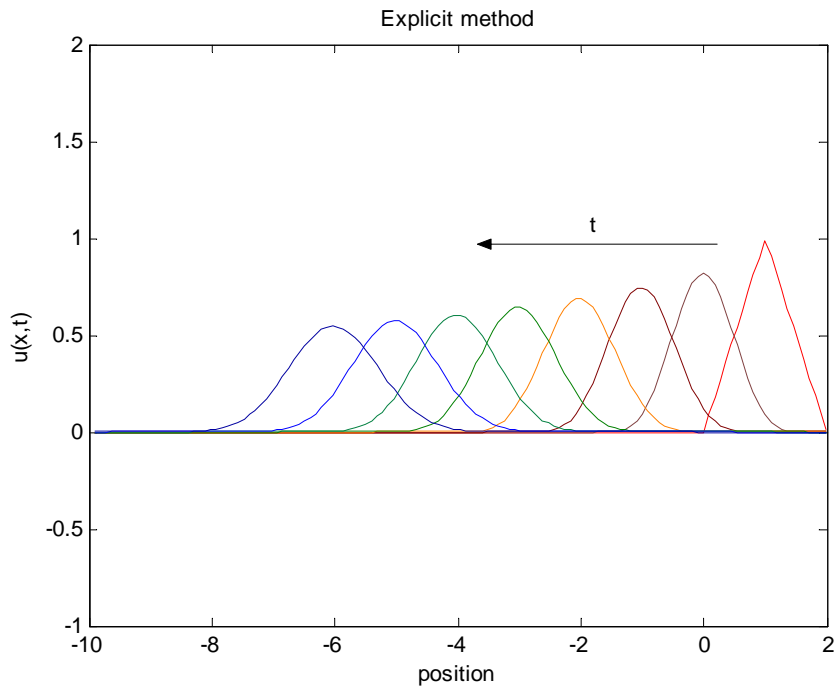


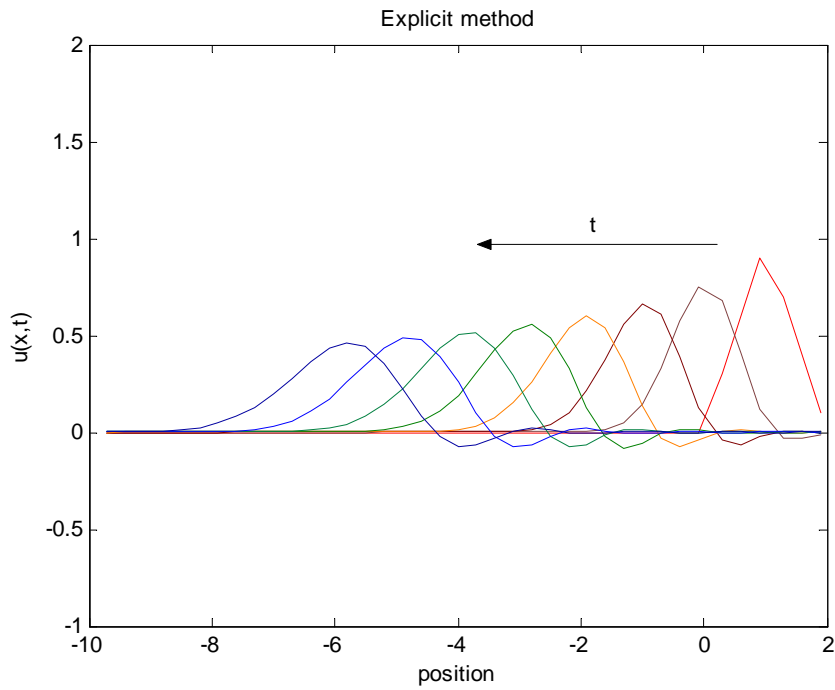
1.  $u_t = cu_x + du_{xx}$  Convection-Diffusion equation (plot @t=1,2,3,...)

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

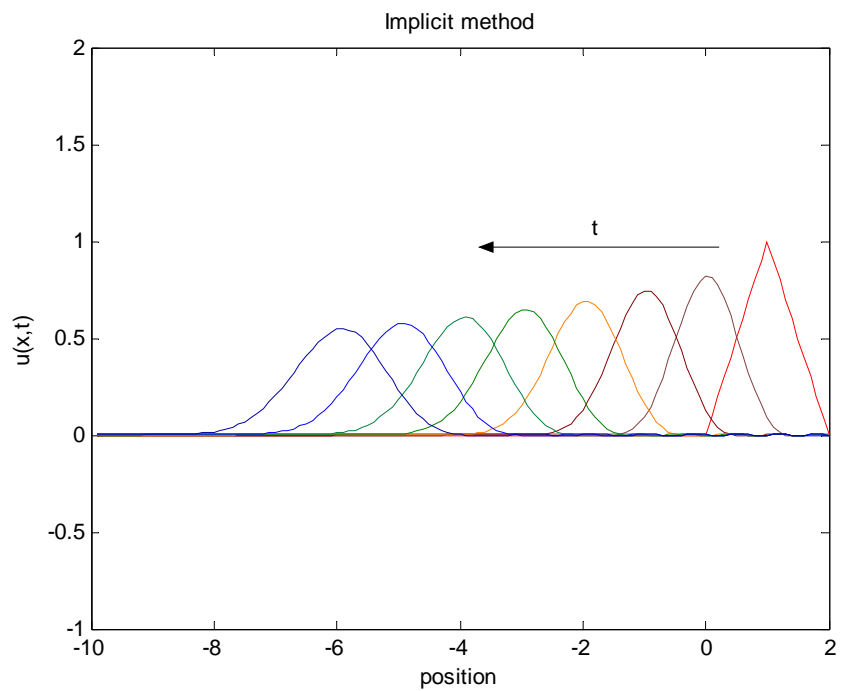
$P=0.9 < 1$  (dx=0.09, r=0.5556, R=0.3086)



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



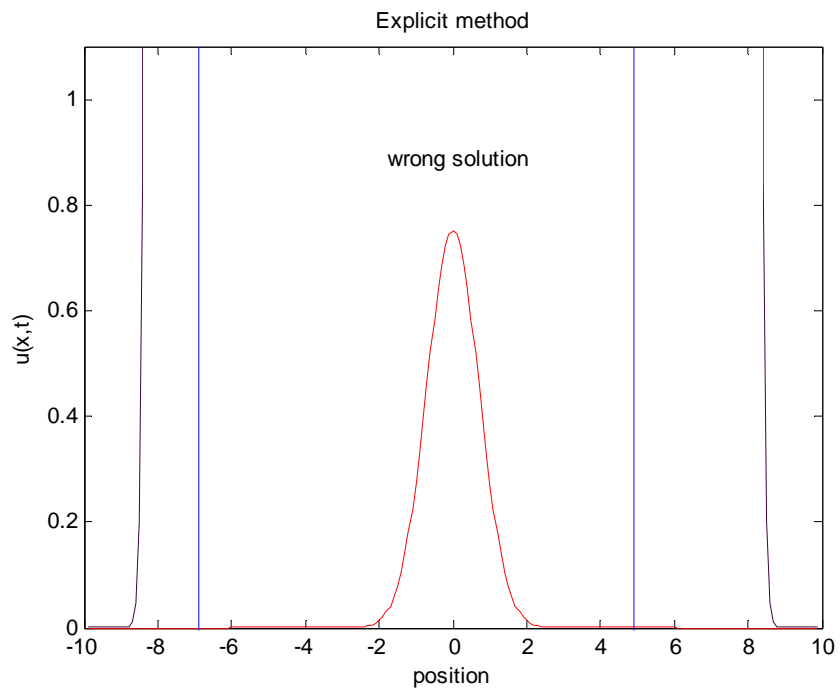
Implicit method ( $dx=0.1$ ,  $dt=0.05$ ,  $c=1$ ,  $d=0.05$ )



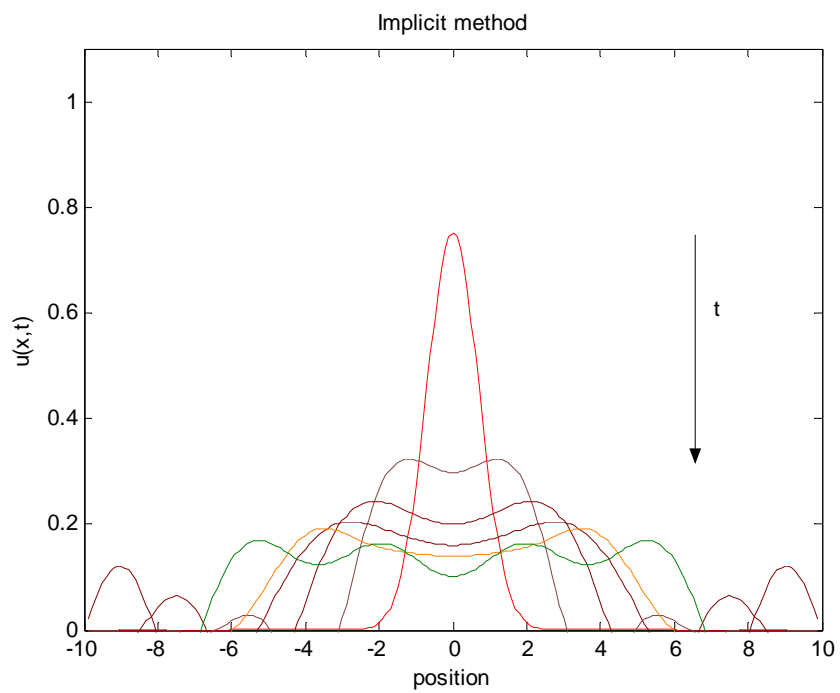
2.  $u_t = iu_{xx}$  Schrödinger equation (plot @t=1,2,3,...)

dt=0.05, dx=0.1

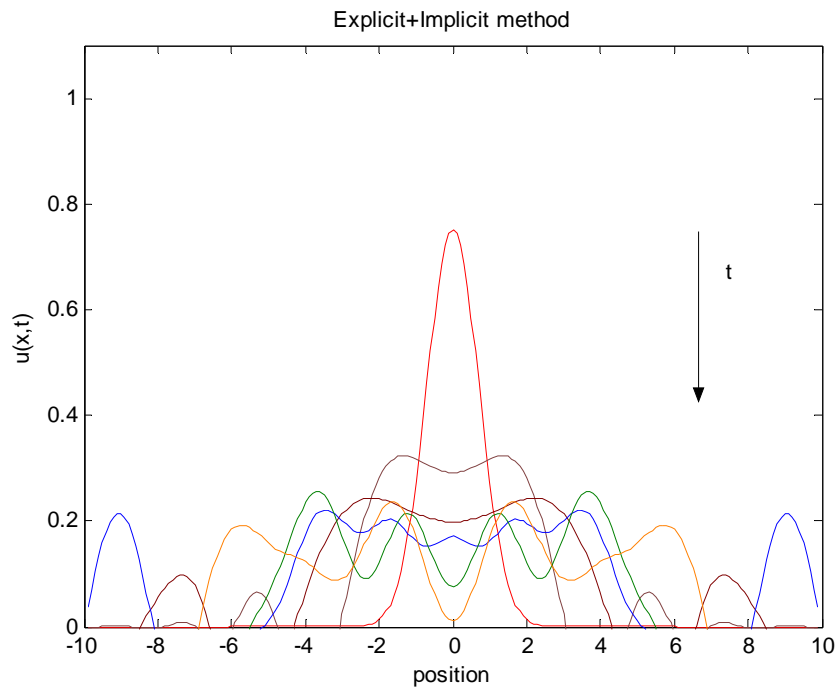
Explicit method (unstable)



Implicit method



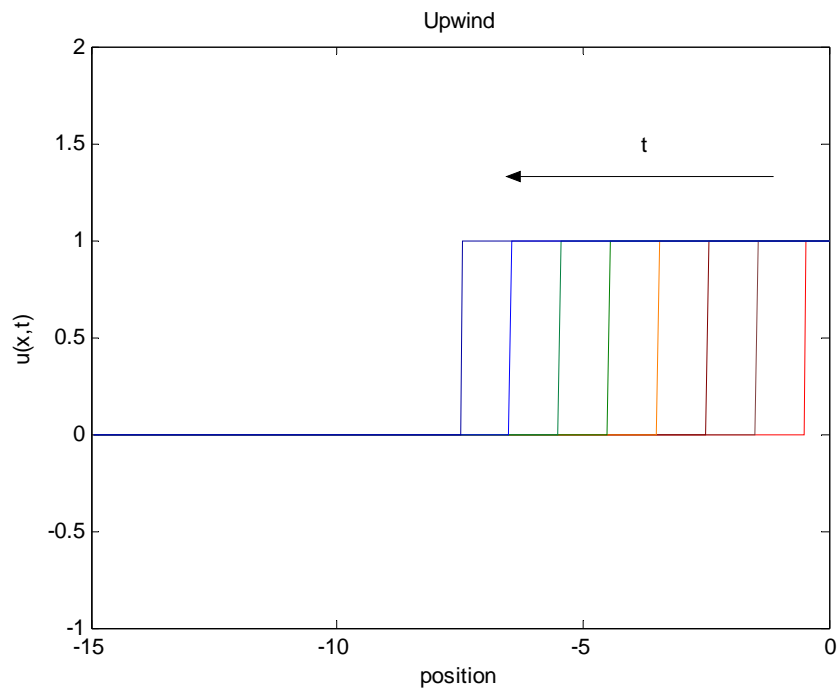
Explicit+ Implicit method



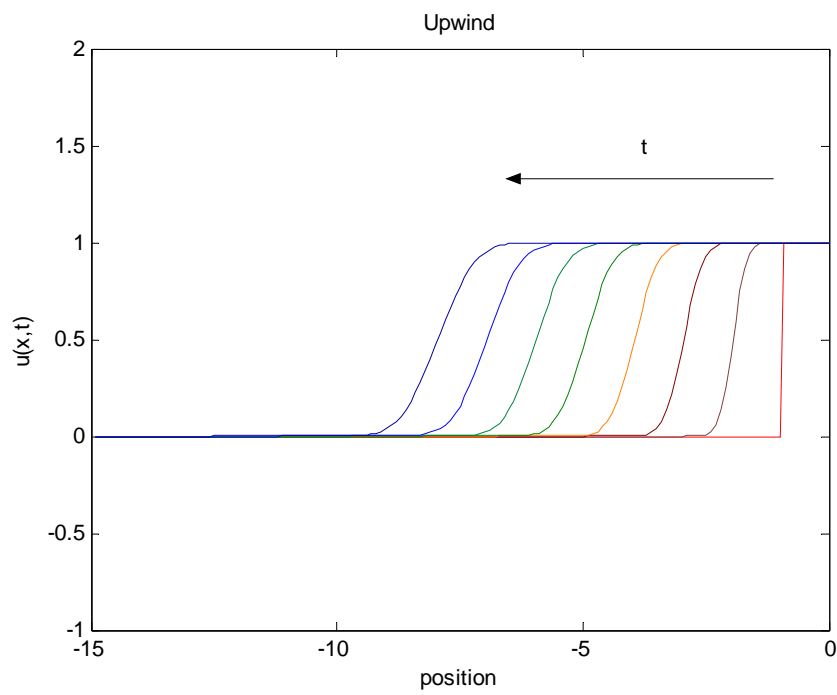
3.  $u_t = u_x$  1-way wave equation (plot @t=1,2,3,...)

Upwind method (dt=0.05)

r=1 (dx=0.05)

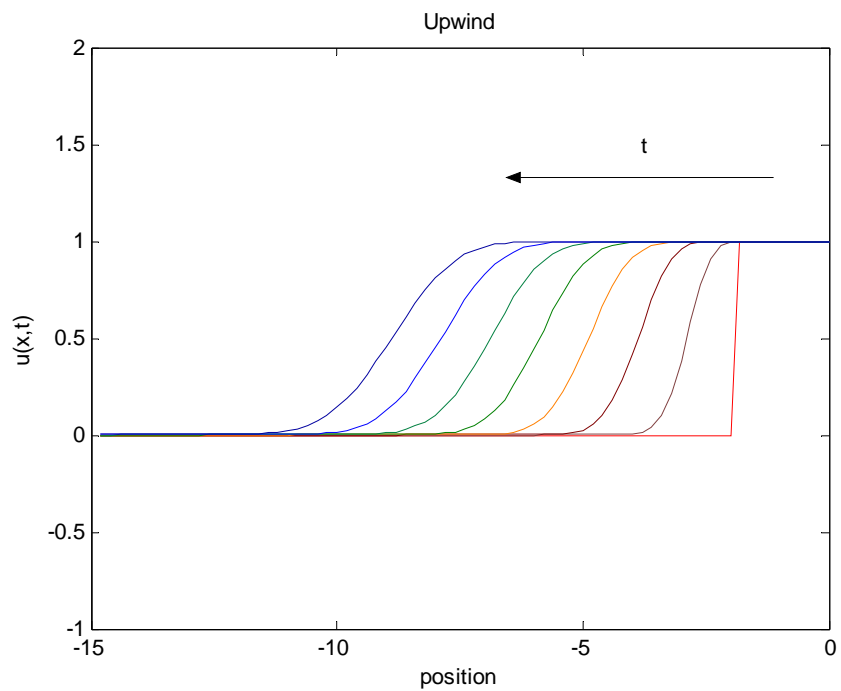


r=0.5 (dx=0.1)



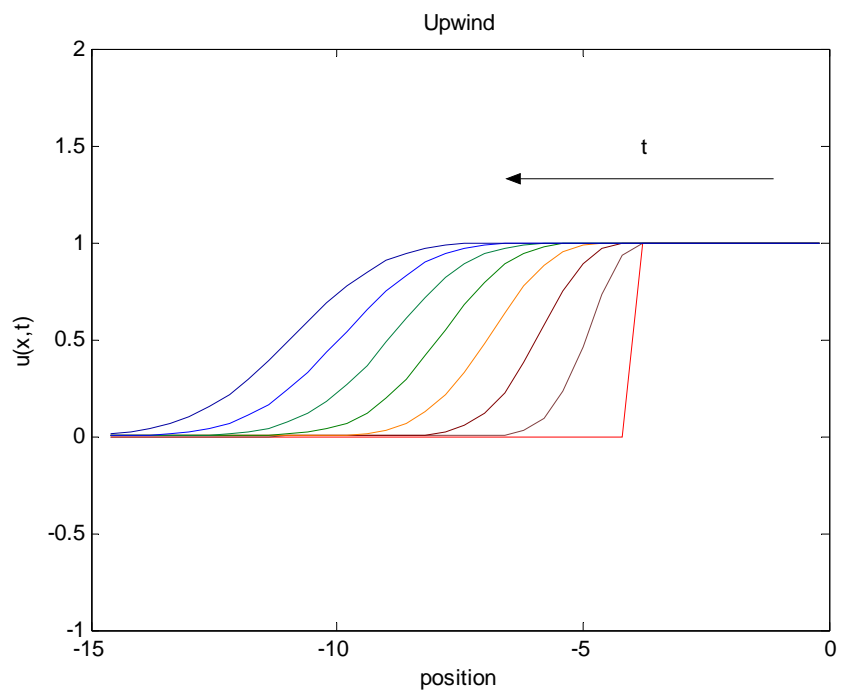
shock\_width (wdx) : w= 7 9 11 13 13 15 17

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



shock\_width (wdx): w = 6 8 9 11 12 13 15

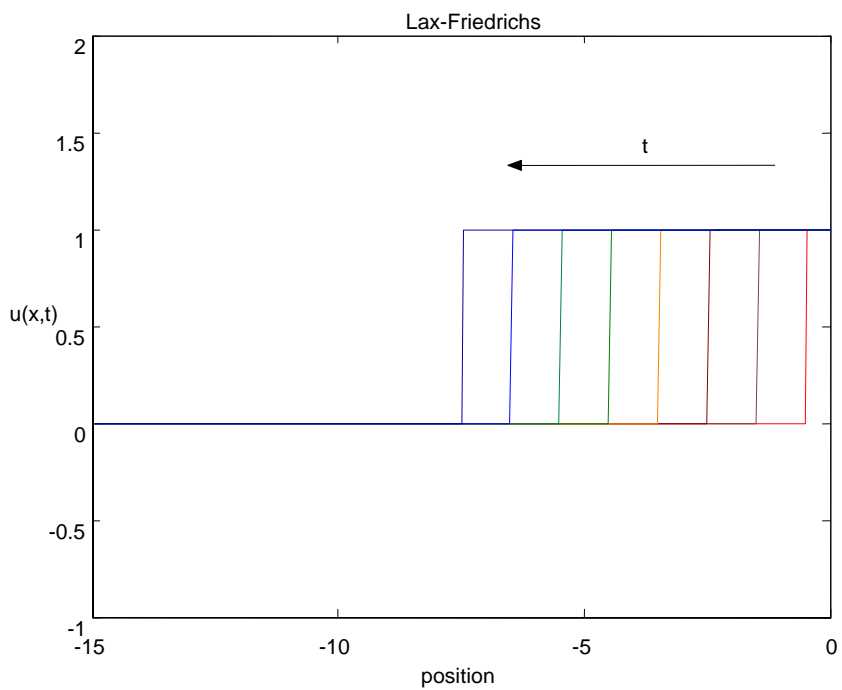
$r=0.125$  ( $dx=0.4$ )



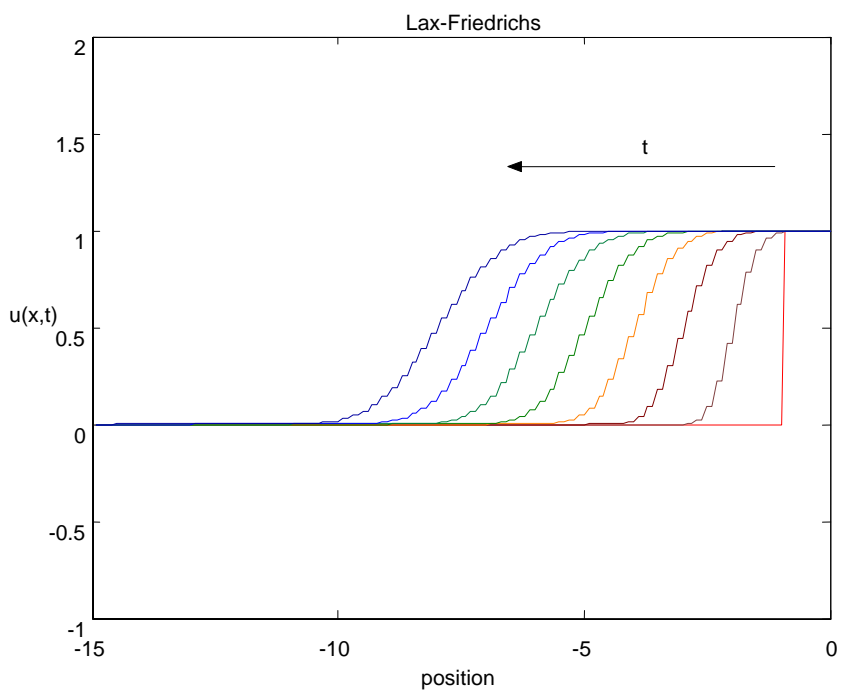
shock\_width (wdx): w = 4 7 8 9 10 11 11

Lax-Friedrichs method ( $dt=0.05$ )

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

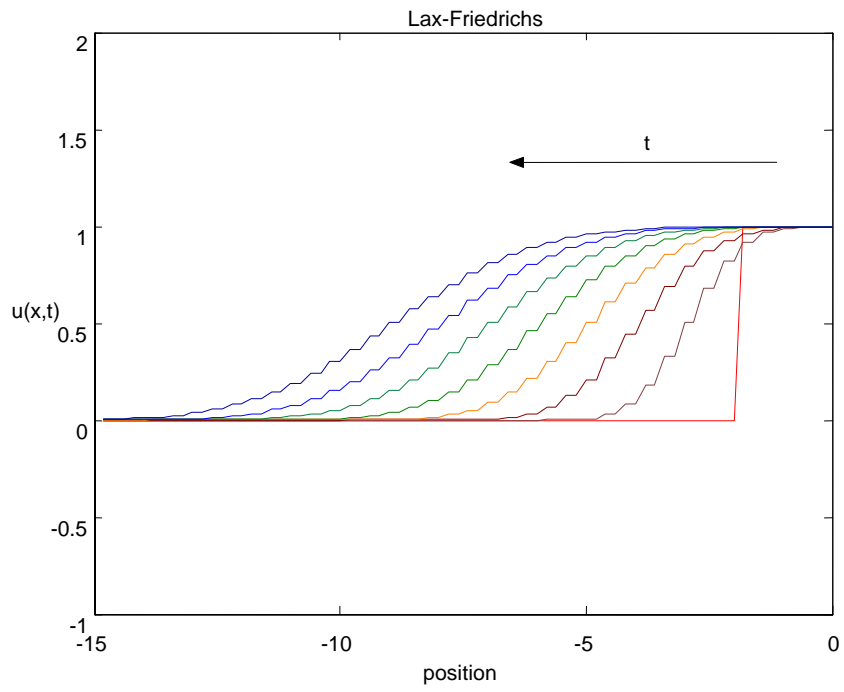


$r=0.5$  ( $dx=0.1$ )



shock\_width (wdx): dx = 11 15 17 21 23 25 29

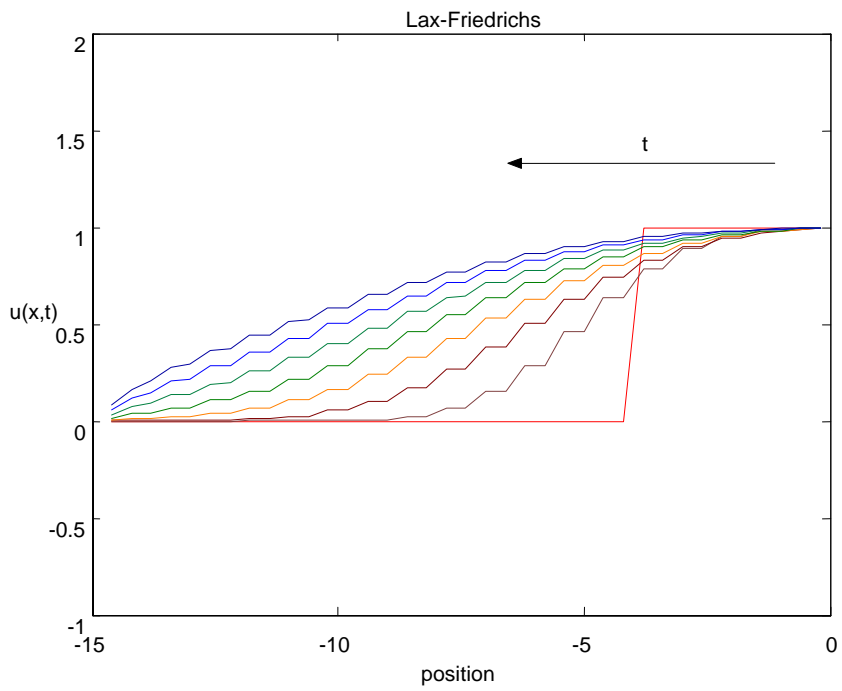
r=0.25 (dx=0.2)



shock\_width (wdx): w = 11 17 19 25 27 29 31

r=0.125 (dx=0.4)

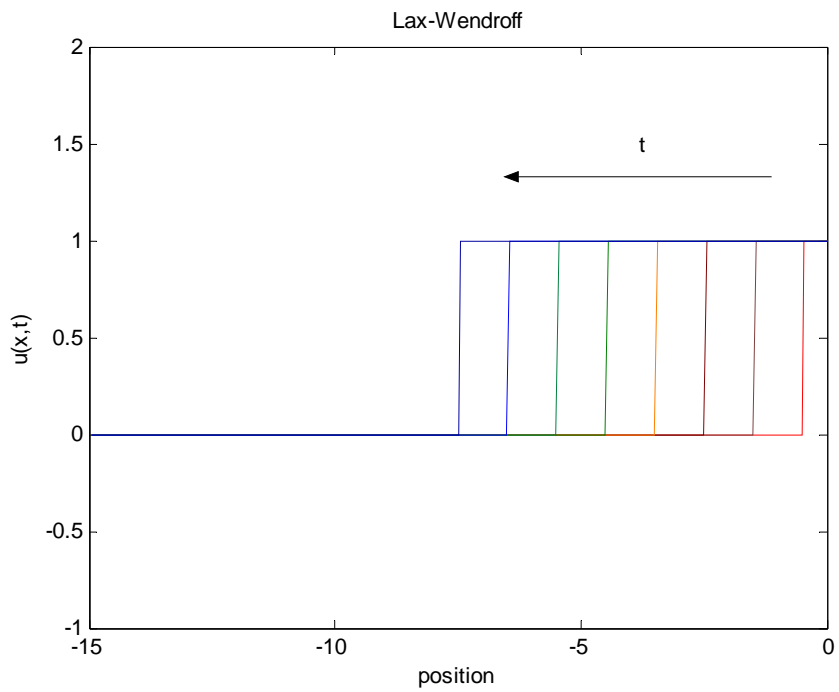




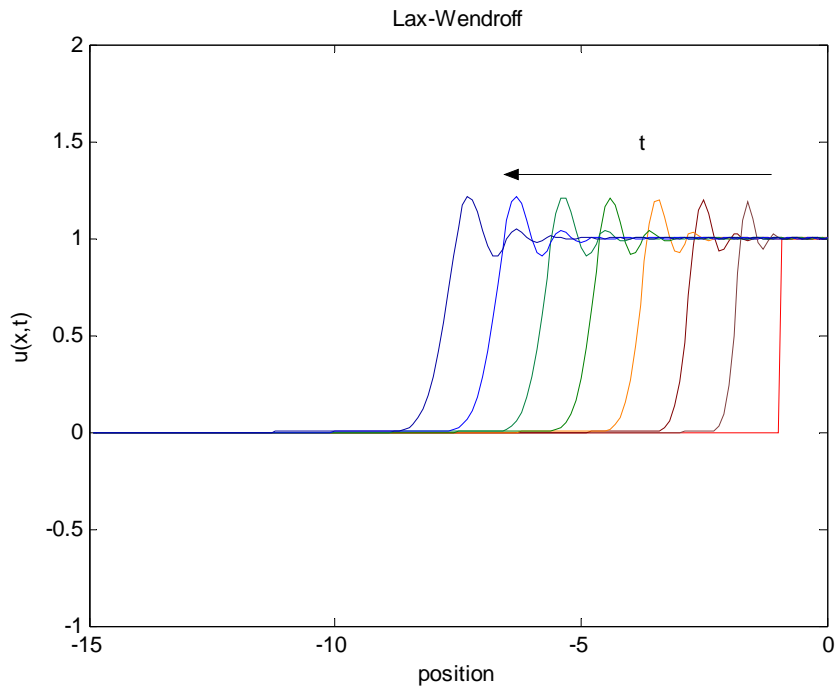
shock\_width (wdx): w = 13 19 21 25 25 25 25

Lax-Wendroff method (dt=0.05)

r=1 (dx=0.05)

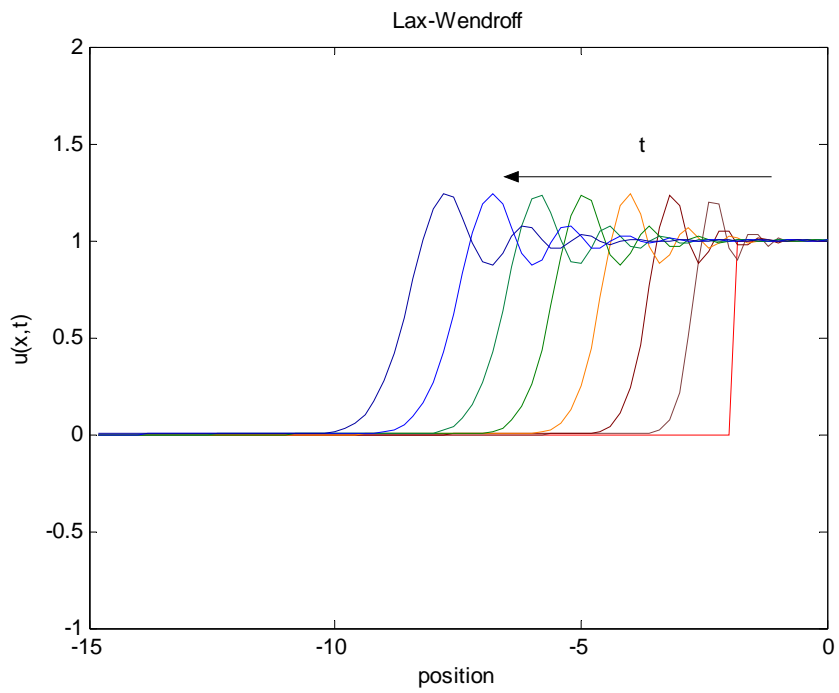


r=0.5 (dx=0.1)



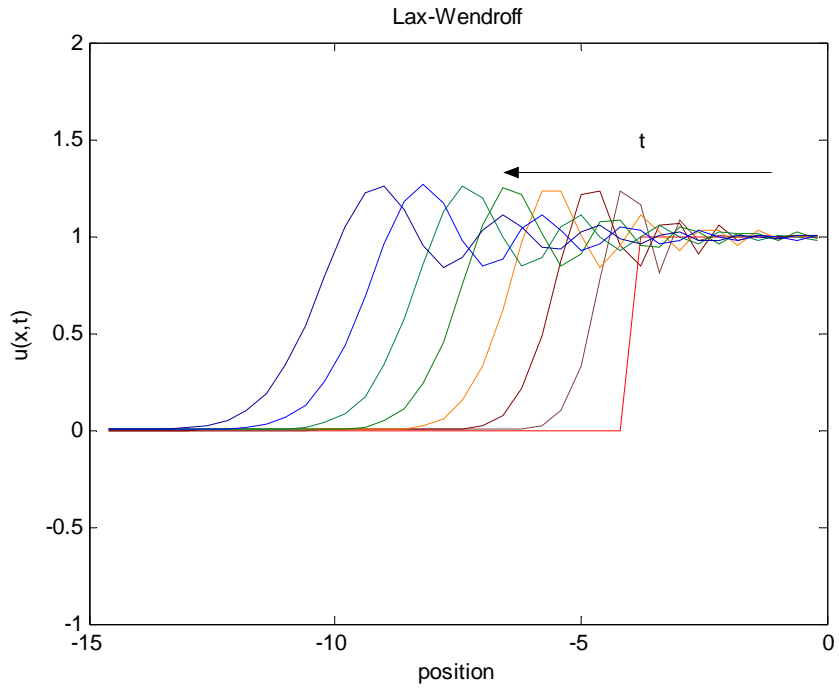
shock\_width (wdx): w = 4 6 7 8 9 9 10

r=0.25 (dx=0.2)



shock\_width (wdx): w = 4 5 6 7 7 8 8

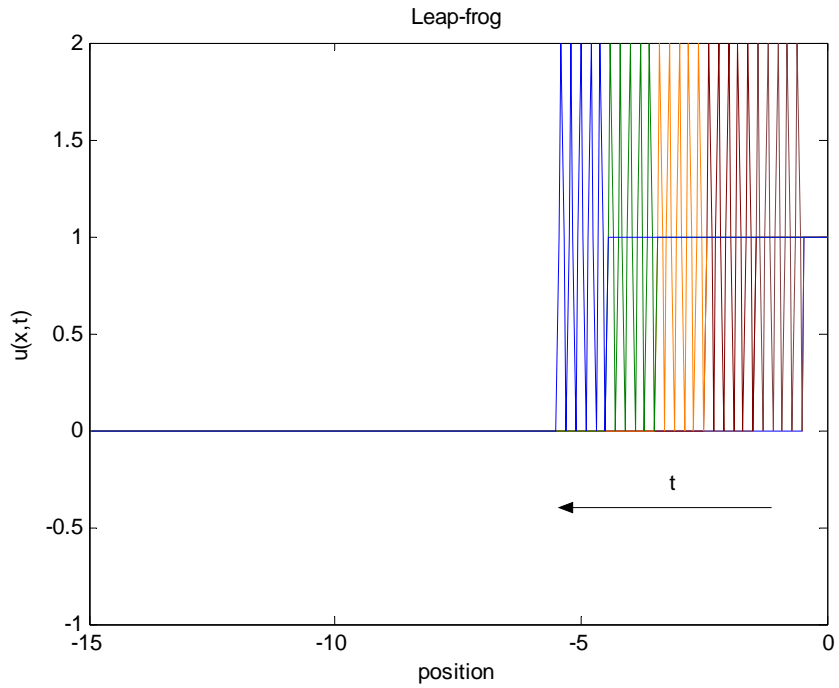
$r=0.125$  ( $dx=0.4$ )



shock\_width (wdx): w = 3 4 5 5 6 7 6

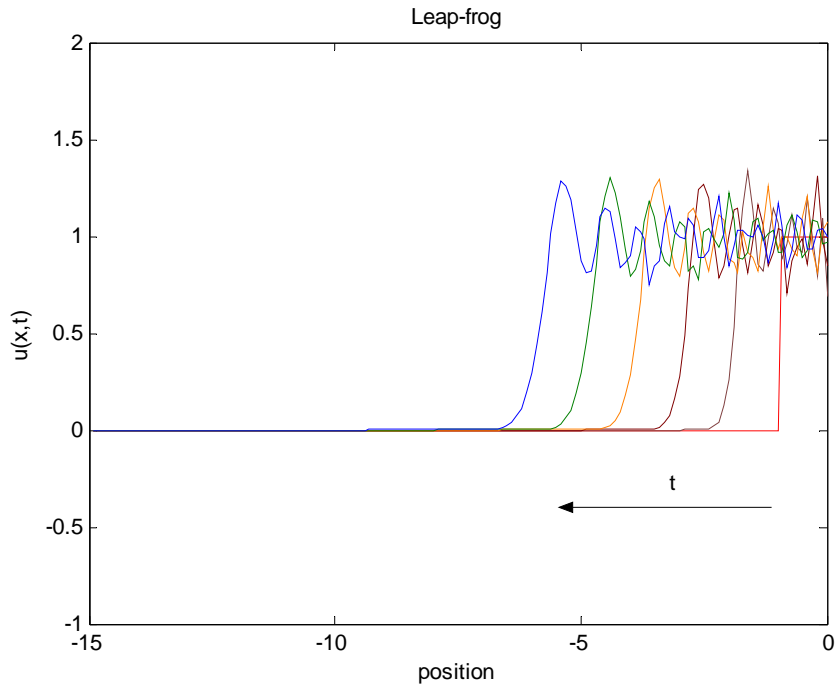
Leap-frog method ( $dt=0.05$ )

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

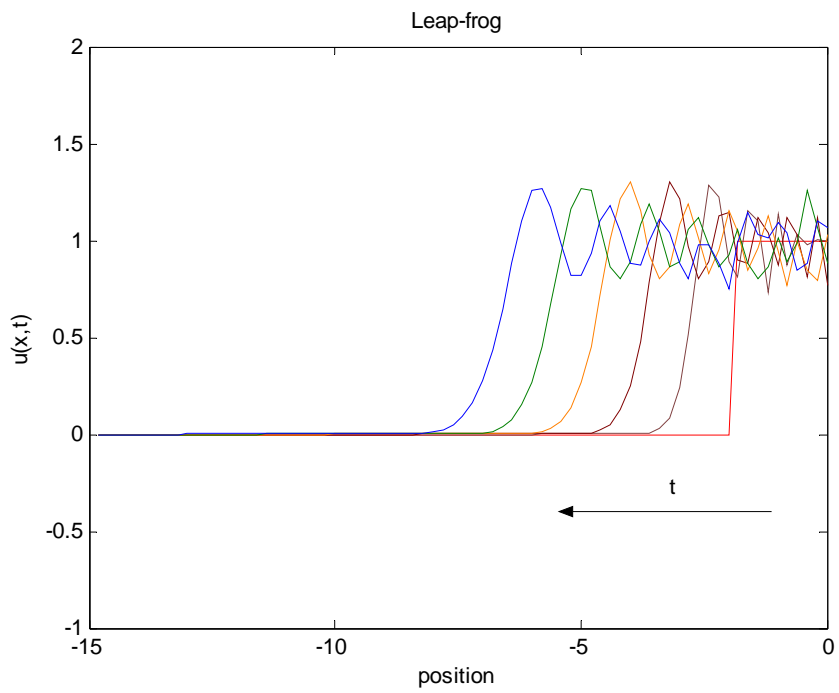


shock\_width (wdx): w = 1 1 1 1 1

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

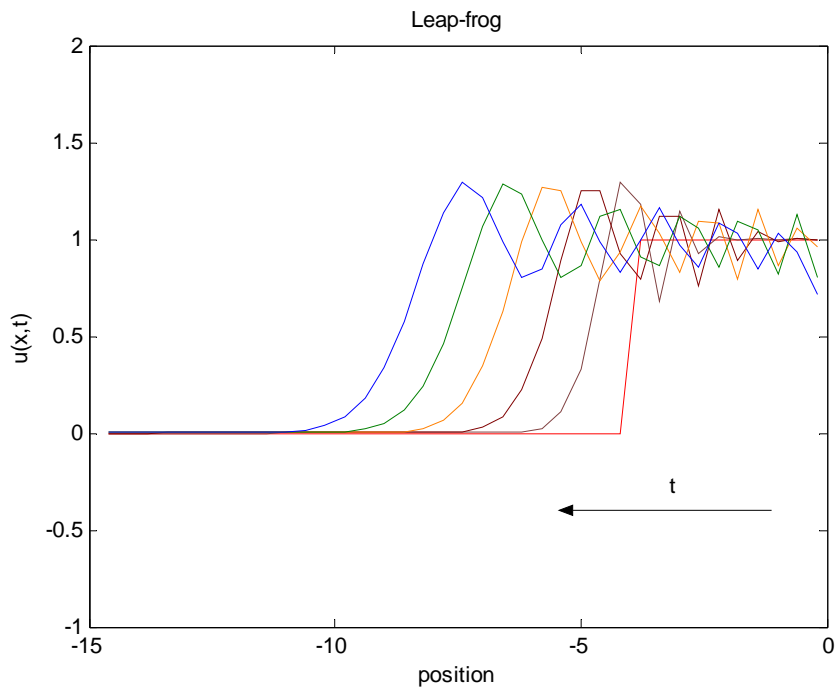


shock\_width (wdx): w = 1 1 1 1 1  
 $r=0.25$  ( $dx=0.2$ )



shock\_width (wdx): w = 1 1 1 1 1

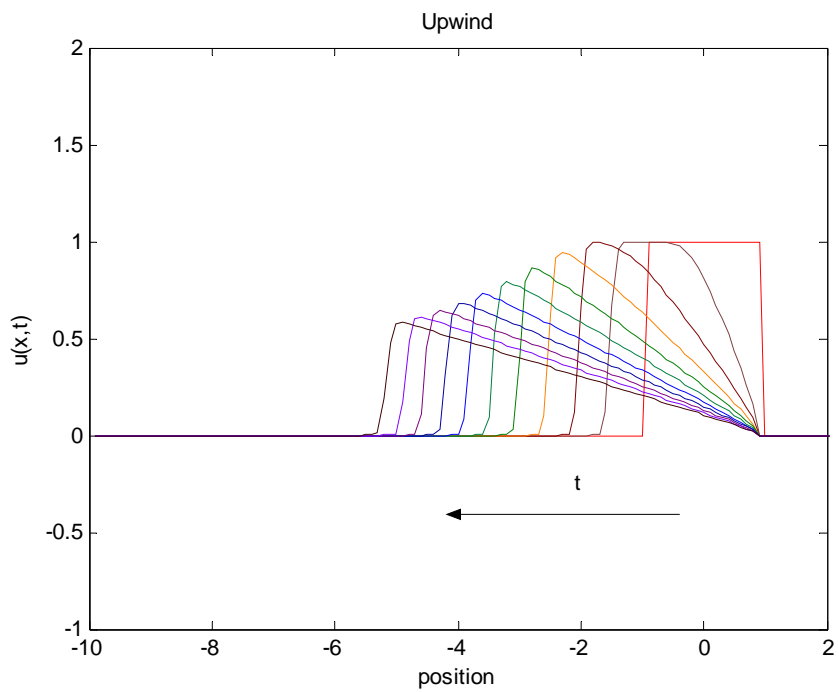
$r=0.125$  ( $dx=0.4$ )



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

