ESSC 4520
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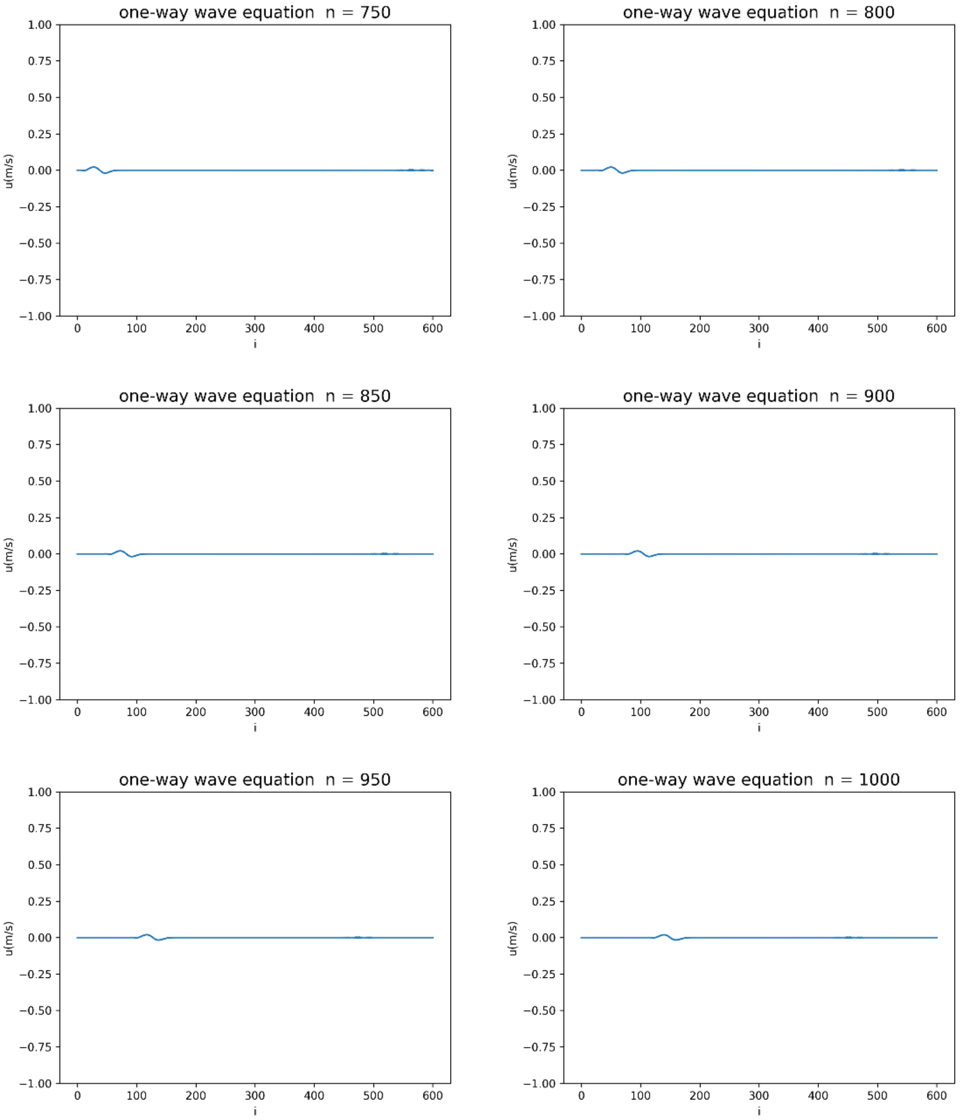
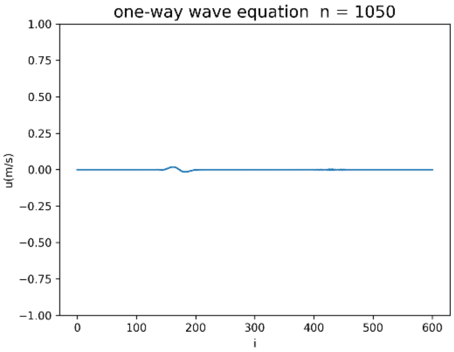
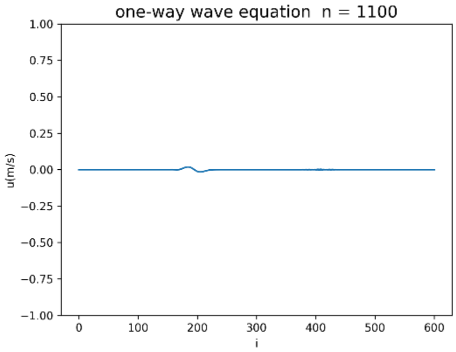
L07/08 Exercise

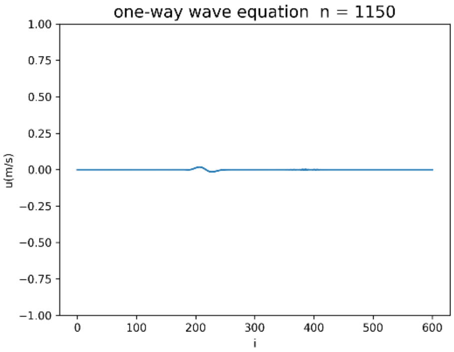
<u>L07 Ex2</u>

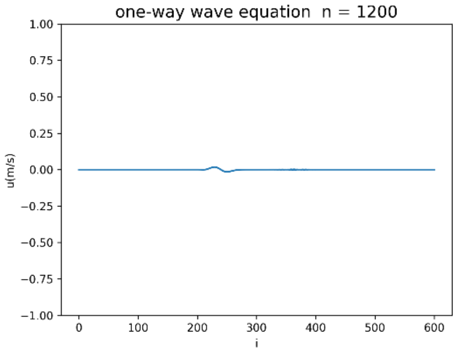
One-way wave equation:




one-way wave equation n = 1050
u(m/s)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
100
200
300
400
500
600
i


one-way wave equation n = 1100
u(m/s)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
100
200
300
400
500
600
i


one-way wave equation n = 1150
u(m/s)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
100
200
300
400
500
600
i


one-way wave equation n = 1200
u(m/s)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
100
200
300
400
500
600
i

L07 Ex3

$$u = F_{right}[x - (U + c)t] + F_{left}[x - (U - c)t]$$

At the right-hand boundary, the one-way wave equation is $\frac{\partial}{\partial t} + (U + c)\frac{\partial}{\partial x} = 0$.

$$\frac{\partial\left(F_{right}[x - (U + c)t]\right)}{\partial t} + (U + c)\frac{\partial\left(F_{right}[x - (U + c)t]\right)}{\partial x}$$

$$= -(U + c)\frac{\partial\left(F_{right}[x-(U+c)t]\right)}{\partial[x-(U+c)t]} + (U + c)\frac{\partial\left(F_{right}[x-(U+c)t]\right)}{\partial[x-(U+c)t]}$$

$$= [-U - c + U + c]\frac{\partial\left(F_{right}[x-(U+c)t]\right)}{\partial[x-(U+c)t]}$$

$$= 0$$

Therefore, the right travelling wave satisfies the one-way wave equation.

$$\frac{\partial\left(F_{left}[x - (U - c)t]\right)}{\partial t} + (U + c)\frac{\partial\left(F_{left}[x - (U - c)t]\right)}{\partial x}$$

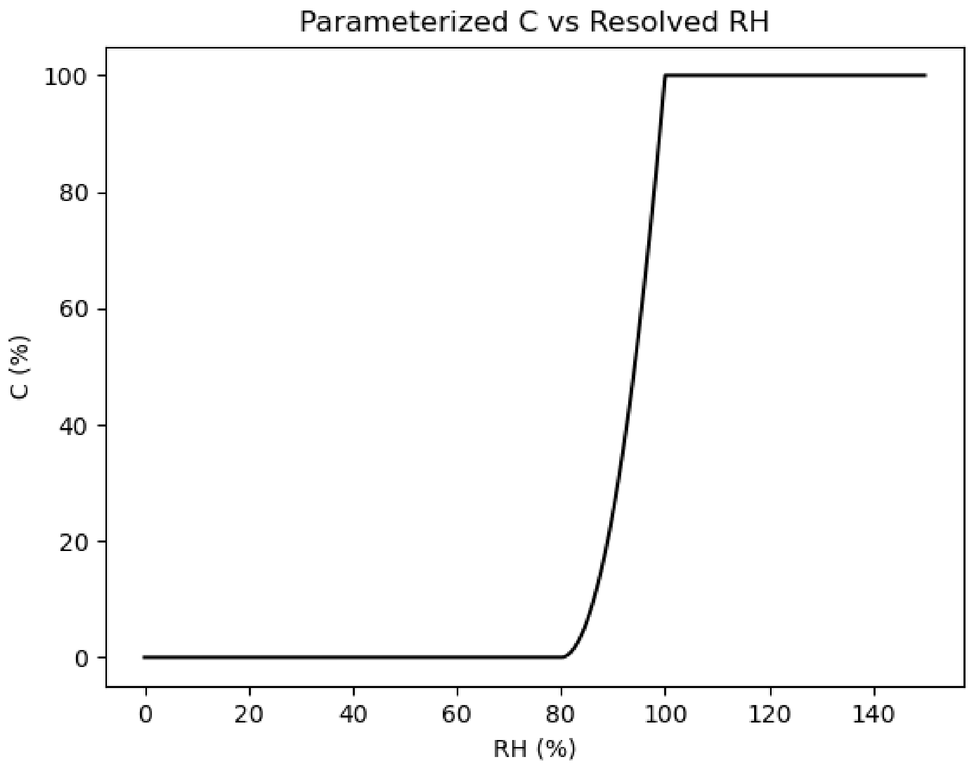
$$= -(U - c)\frac{\partial\left(F_{left}[x-(U-c)t]\right)}{\partial[x-(U-c)t]} + (U + c)\frac{\partial\left(F_{left}[x-(U-c)t]\right)}{\partial[x-(U-c)t]}$$

$$= [-U + c + U + c]\frac{\partial\left(F_{left}[x-(U-c)t]\right)}{\partial[x-(U-c)t]}$$

$$= 2c \neq 0$$

Therefore, the left travelling wave does not satisfy the one-way wave equation.

L08 Ex1


Parameterized C vs Resolved RH
C (%)
RH (%)
0
20
40
60
80
100
0
20
40
60
80
100
120
140