

Adveksi Tengah

Untuk memudahkan penjabaran, maka didefinisikan variabel sbb:

$$\begin{aligned}C_{in1} &= C(i, n+1) \\C_{in} &= C(i, n) \\C_{plusn} &= C(i+1, n) \\C_{minn} &= C(i-1, n)\end{aligned}$$

$$\text{Adveksi} := (C_{in1} - C_{in})/\Delta t + U (C_{plusn} - C_{minn})/2/\Delta x$$

$$\text{Taylor} := \left\{ \begin{array}{l} C_{in1} \rightarrow C_{in} + \partial C/\partial t \Delta t + \partial^2 C/\partial t^2 \Delta t^2/2, \\ C_{minn} \rightarrow C_{in} - \partial C/\partial x \Delta x + \partial^2 C/\partial x^2 \Delta x^2/2, \\ C_{plusn} \rightarrow C_{in} + \partial C/\partial x \Delta x + \partial^2 C/\partial x^2 \Delta x^2/2 \end{array} \right\}$$

$$\text{Identitas} := \partial^2 C/\partial t^2 \rightarrow U^2 \partial^2 C/\partial x^2$$

$$\text{AdveksiNew1} := \text{Adveksi}/.\text{Taylor}/.\text{Identitas}$$

$$\text{AdveksiNew2} = \text{ExpandAll}[\text{AdveksiNew1}]$$

$$\partial C/\partial t + U \partial C/\partial x + \frac{U^2 \partial^2 C/\partial x^2 \Delta t}{2}$$

$$\begin{aligned}\text{AdveksiBaru} &:= \partial C/\partial t + U \partial C/\partial x - K_n \partial^2 C/\partial x^2; \\K_n &:= -U^2 \Delta t/2\end{aligned}$$

$$\text{Selisih} = \text{Simplify}[(\text{AdveksiBaru} - \text{AdveksiNew2})/.\text{Identitas}]$$

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Jika didefinisikan $Cr = U\Delta t/\Delta x$, maka kecepatan dapat ditulis sebagai:

$$\text{Identitas3} := U \rightarrow Cr \Delta x/\Delta t$$

sehingga K_n dapat ditulis sebagai:

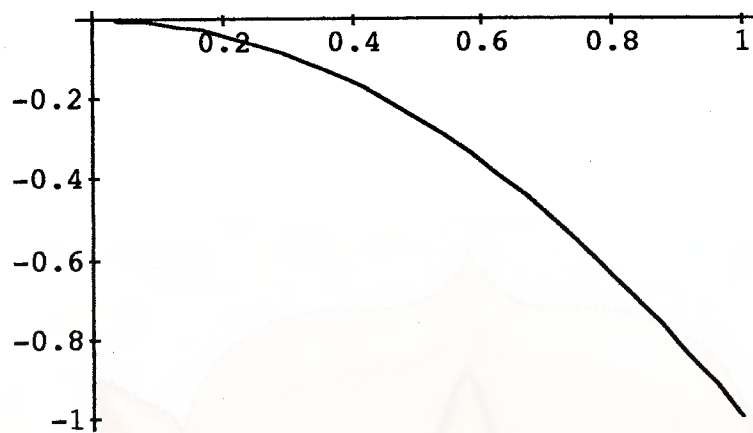
$$K_{nbaru} := \text{Simplify}[K_n /. \text{Identitas3}]; K_{nbaru}$$

$$-\left(\frac{Cr^2 \Delta x}{2 \Delta t}\right)$$

Djoko Luknanto, *[Signature]*

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Plot [Knbaru/.{ $\Delta x \rightarrow 1, \Delta t \rightarrow 1/2$ }, {Cr, 0, 1}]



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Djoko Luknanto *[Signature]*