NO! see yellow sticker below

Derivation of equivalence between stage model and rate-based model

Stage

\[ \text{dh} \]

\[ \text{dh} \]

Mass balance of a given component

\( L_{x_{n+1}} = V y_n + d \)

Assume equilibrium

\( y_n = y_n^\ast \) \((-\Delta x\ell(x_n))\)

Rewrite mass balance

\[ x_{n+1} - x_n = \frac{V}{k_{As}} y_n^\ast - x_n + \frac{d}{L} \]

Mass transfer in liquid phase over differential height \( \text{dh} \)

\[ \frac{\Delta v}{L} \]

\[ \Delta x \]

\( L(x+\Delta x) - L_x = k_{v} a_S \Delta h \)

\( (y^\ast - y) \)

\( \text{Ldx} \)

Get

\[ \frac{dx}{\text{dh}} = \frac{k_{v}a_{S}}{L} (y^\ast - y) \]

or

\[ \frac{d\Delta t}{H_{oc}} \]

\( \frac{V}{k_{As}} \)

\[ \frac{dx}{\text{dh}} = \frac{\Delta v}{\text{L}} (y^\ast - y) \]

Let \( H_{oc} \) be "height of transfer unit" (stage) and assume \( \frac{dx}{\text{dh}} \) is constant over length \( H_{oc} \),

Then

\[ \frac{dx}{\text{dh}} \approx \frac{x_{n+1} - x_n}{H_{oc}} \]

and mass balance becomes

\[ x_{n+1} - x_n = \frac{V}{k_{As}} (y^\ast - y) = \frac{V x^\ast - x + \frac{d}{L}}{\text{L}} \]

q.e.d.