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Graphical Method for Co Current Extraction

Stage 1: $E_0 + R_2 = E_1 + R_1$

rearrange to $E_0 - R_1 = E_1 - R_2 \equiv \Delta$
delta

$\therefore \Delta =$ difference in flowrate
of passing streams

Stage 2: $E_0 + R_3 = E_2 + R_2$

or $E_1 - R_2 = E_2 - R_3 \equiv \Delta$

$\therefore \Delta = E_0 - R_1 = \dots E_j - R_{j+1} = E_N - R_{N+1}$

Now write component mass balances

$\frac{MB}{A}$: $\Delta = E_0 - R_1 = E_j - R_{j+1} = E_N - R_{N+1}$
 $\Delta \cdot X_A^{(\Delta)} = E_0 Y_{A0} - R_1 X_{A1} = E_j Y_{Aj} - R_{N+1} X_{A,N+1}$

and

$\frac{MB}{B}$: $\Delta \cdot X_B^{(\Delta)} = E_0 Y_{B0} - R_1 X_{B1} = \dots$

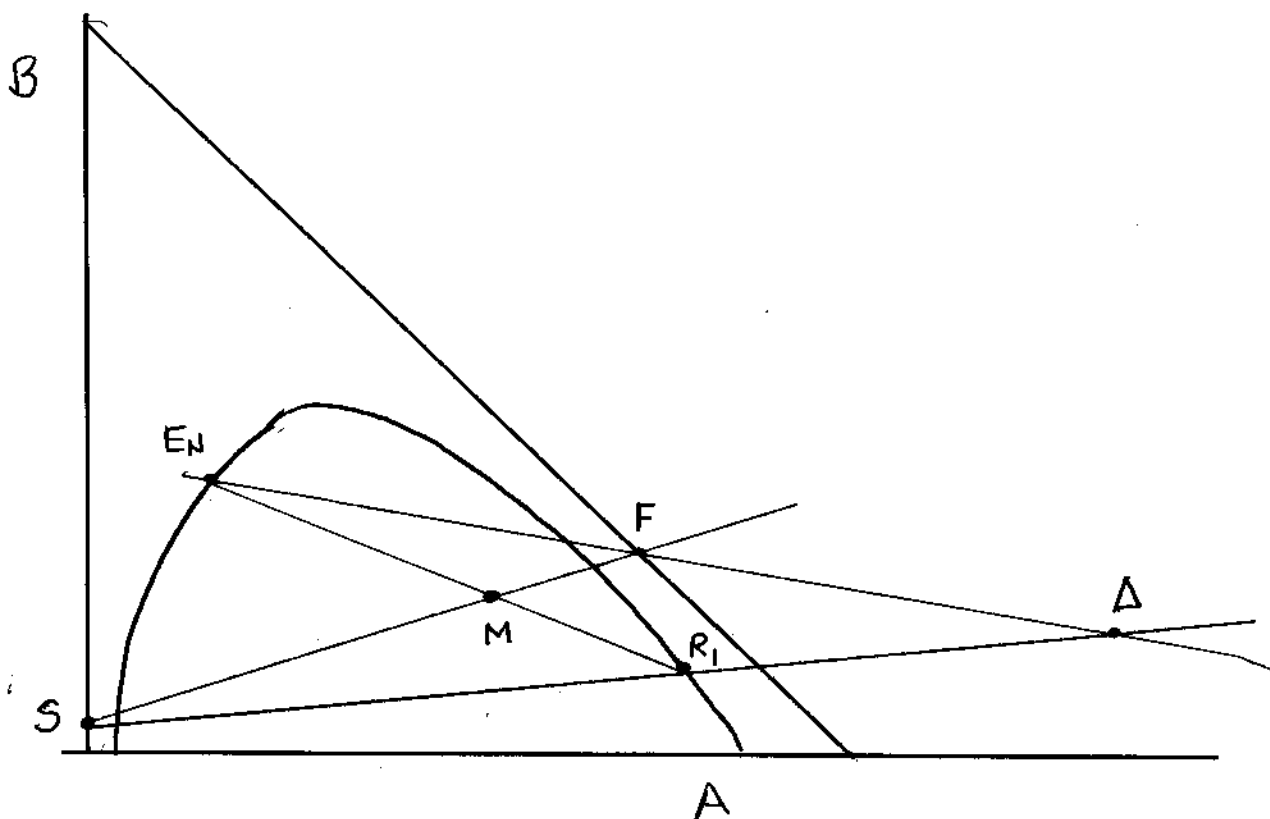
solving for $X_A^{(\Delta)} = (E_0 Y_{A0} - R_1 X_{A1}) / \Delta$

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$$X_B^{(\Delta)} = (E_0 Y_{B0} - R_1 X_{B1}) / \Delta$$

Note $X_A^{(\Delta)}$ & $X_B^{(\Delta)}$ are the coordinates of a point on the diagram (point " Δ ").

Rather than an operating line (single) as we did for distillation, we now have an operating point "delta" (also called the difference point) through which all operating lines pass.



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Procedure

- (1) Locate S, F, M & E_N or R_1
- (2) Locate Δ
- (3) Use TL to find E_1
- (4) Use Δ to find R_2
- (5) Use TL to find E_2
- (6) Use Δ to find R_3

etc to exceed E_N

(7) Count "N"

