

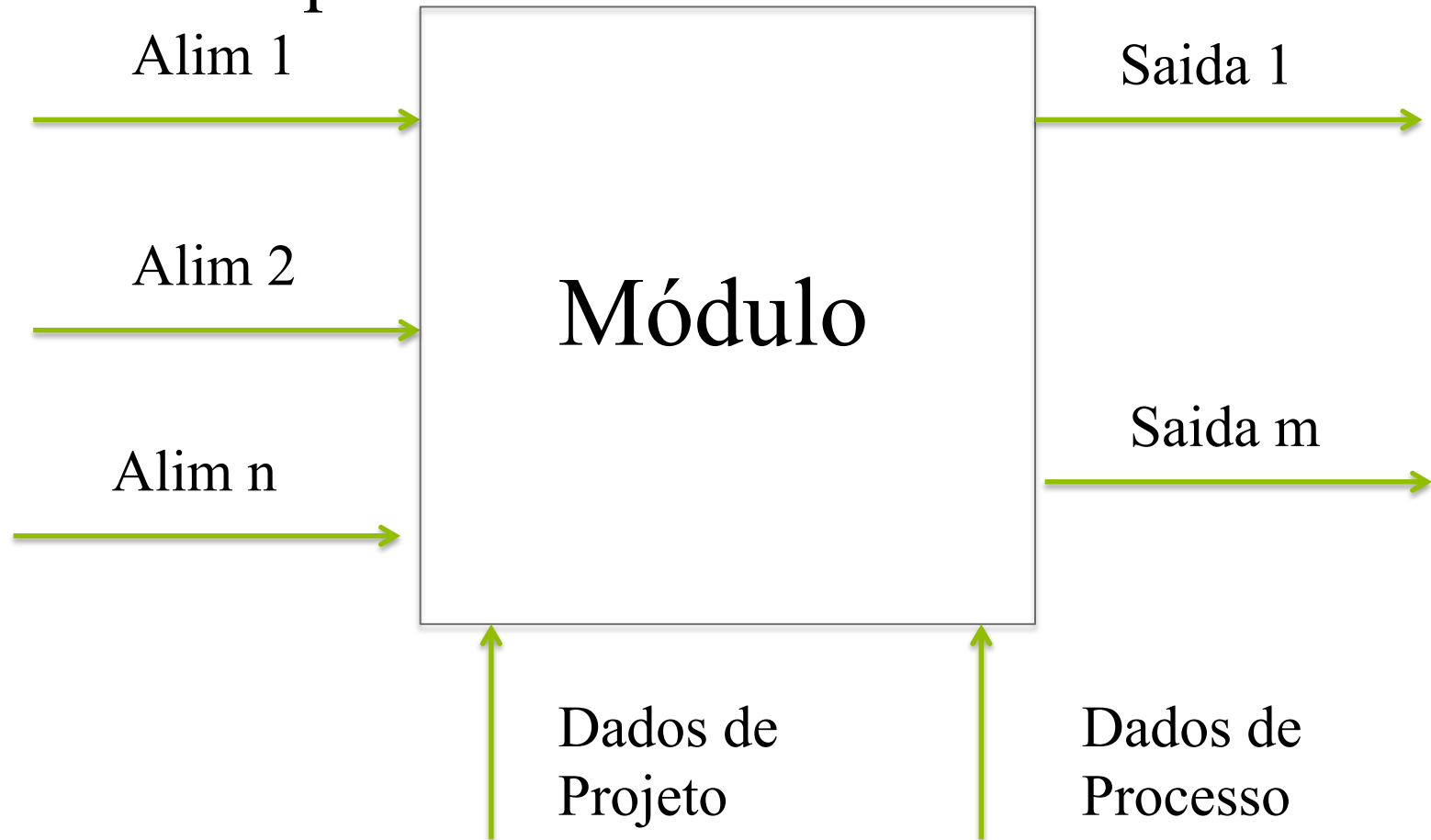
Aula 3

Trocadores de Calor e Flash

TROCADORES DE CALOR

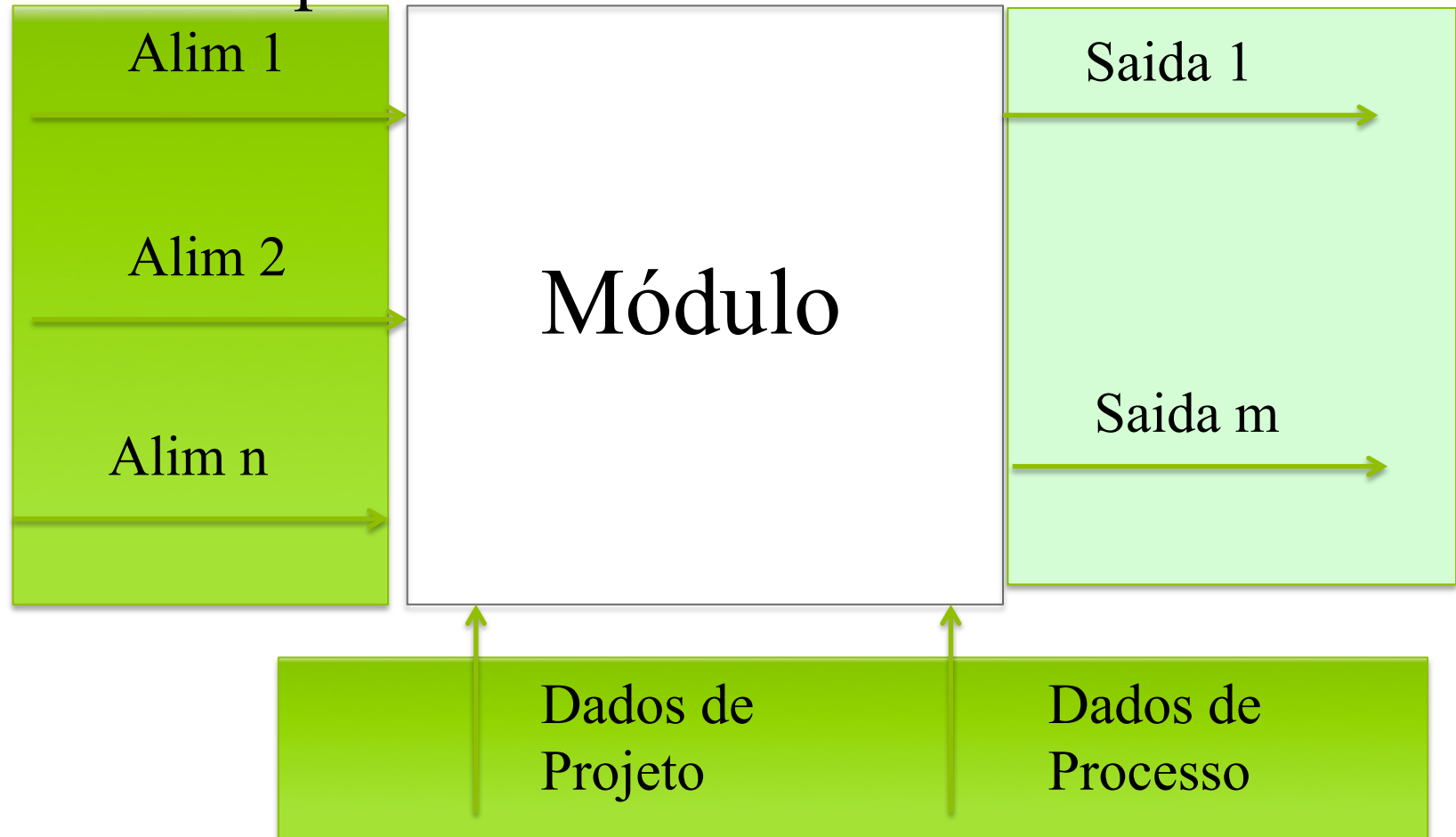
Simulador Modular

- Princípio



Simulador Modular

- Princípio



Outline

- Correntes Materiais
- Trocadores de Calor
 - Simples - Heater
 - Entre correntes - HeatX

Corrente Material

- Regra das fases de Gibbs

$$F = NC - NP + 2$$

- Estabelece graus de liberdade para variáveis intensivas, em sistemas em equilíbrios
- Corrente Material:

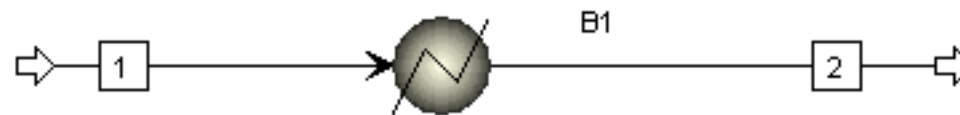
$$G.L. = NC + 2$$

sendo no máximo F variáveis intensivas

Trocadores de Calor - Simples

HEATER

Representa um sistema de aquecimento simplérrimo



Eqs: $BM_s + BE = C + 1$

Incognitas : $C + 2 + 1 (Q)$

GL: 2

HEATER

Start Page x Main Howsheet x B1 (HeatX) x Control Panel x STR1 (MATERIAL) - Results x **b2 (heater)**

Specifications Flash Options Utility Information

Flash specifications

Flash Type: Temperature Pressure

Temperature: C

Temperature change: C

Degrees of superheating: C

Degrees of subcooling: C

Pressure: bar

Duty: cal/sec

Vapor fraction:

Pressure drop correlation parameter:

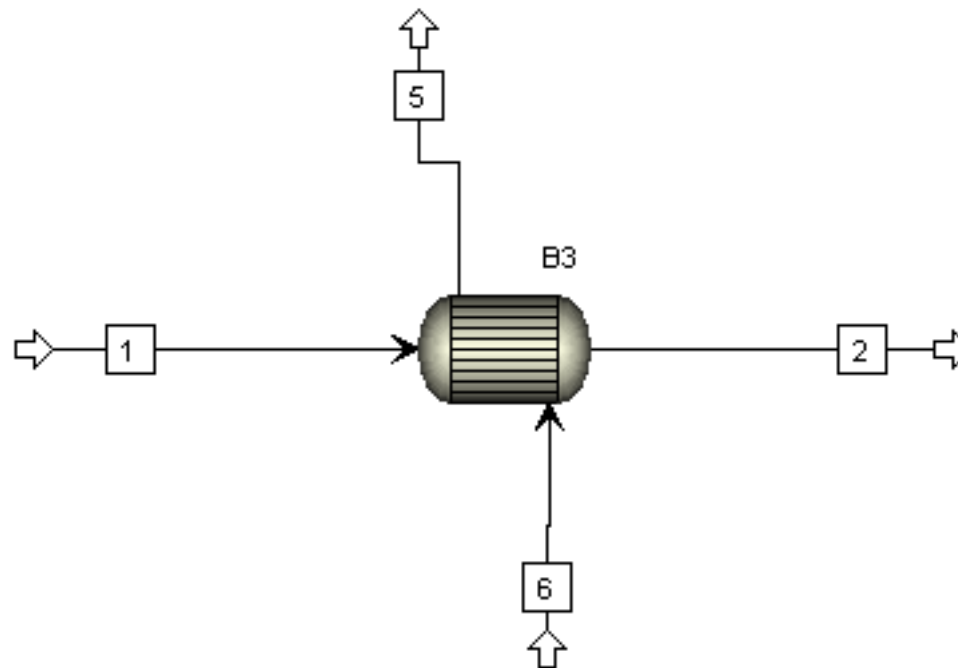
Valid phases

Vapor-Liquid

Duas especificações ...

Flash? Sim Flash, mas não separa as correntes

Trocador - HeatX



Dois lados: quente e frio
3 formas de utilização principais

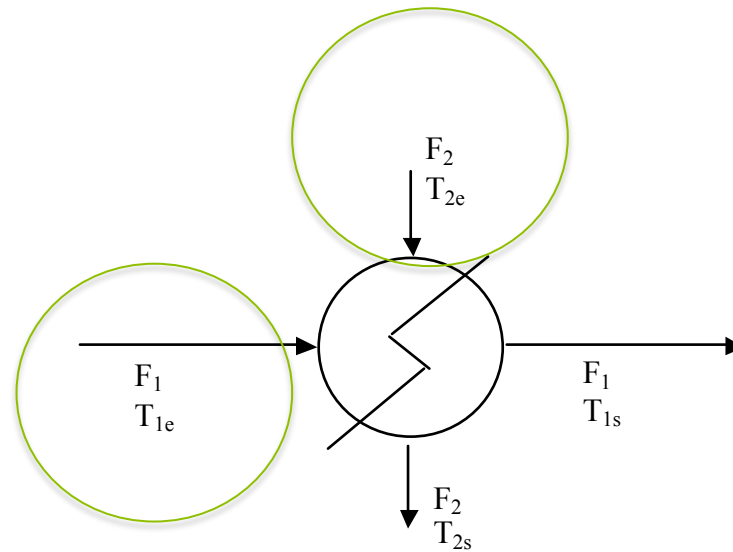
Trocador - HeatX

The screenshot displays the 'Specifications' tab of the HeatX software. The interface is organized into several sections:

- Calculation:** Includes radio buttons for 'Shortcut' (selected), 'Detailed', and 'Rigorous'. Below these is a dropdown menu set to 'Size Shell&Tube' and a checkbox for 'Use Design Template File'.
- Flow arrangement:** Features dropdown menus for 'Hot fluid', 'Flow direction' (set to 'Countercurrent'), and 'No. shells in series' (set to '1'). A checkbox for 'Calculate number of shells' is present.
- Rigorous Model:** Includes radio buttons for 'Shell&Tube', 'AirCooled', and 'Plate', along with a 'Transfer UA to shortcut' button.
- Exchanger specification:** Contains dropdown menus for 'Specification' (set to 'Hot stream outlet temperature'), 'Value' (set to '70'), and 'C' (set to 'C'). It also includes fields for 'Exchanger area' (set to '10' and 'sqm'), 'Constant UA' (set to 'cal/sec-K'), and 'Minimum temperature approach' (set to '1' and 'C').

Usos diferentes: Simulation, design, rating
À esquerda: Shortcut, detailed, ...

Trocador – HeatX



Trocador – HeatX

Design + Shortcut:

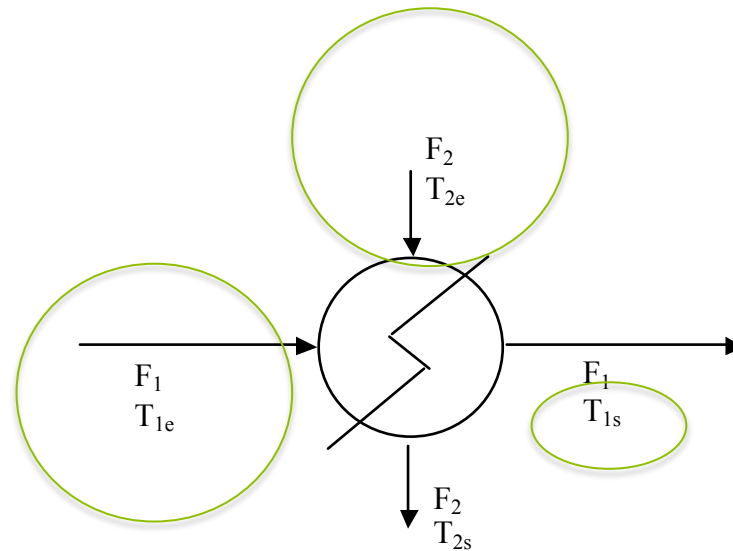
$$\begin{array}{ll} \text{Eqs: BMs lado frio:} & \text{NC} \\ \text{BMs lado quente:} & \text{NC} \\ \text{BE} & 1 \\ \text{Total} & = 2 \text{ NC} + 1 \end{array}$$

Incongnitas: $2 \text{ NC} + 4$

GL: 3

Trocador – HeatX - Design

Design + Shortcut:



1 especificação de saída, mais dois ΔP

Da equação $Q = UA \Delta T_{LM}$, calcula-se UA

Trocador – HeatX - Simulation

Simulation + Shortcut:

The screenshot displays the HeatX simulation software interface with the following settings:

- Specifications:** Selected
- Streams:** (tab)
- LMTD:** (tab)
- Pressure Drop:** (tab)
- U Methods:** Selected
- Film Coefficients:** (tab)
- Utilities:** (tab)
- Information:** (tab)

Calculation:

- Shortcut
- Detailed
- Rigorous
- Size Shell&Tube (dropdown)
- Use Design Template File

Flow arrangement:

- Hot fluid: (dropdown)
- Flow direction: *Countercurrent* (dropdown)
- No. shells in series: 1 (input)
- Calculate number of shells

Rigorous Model:

- Shell&Tube
- AirCooled
- Plate
- Transfer UA to shortcut (button)

Type: Simulation (dropdown)

Exchanger type: Heat exchanger (dropdown)

Exchanger specification:

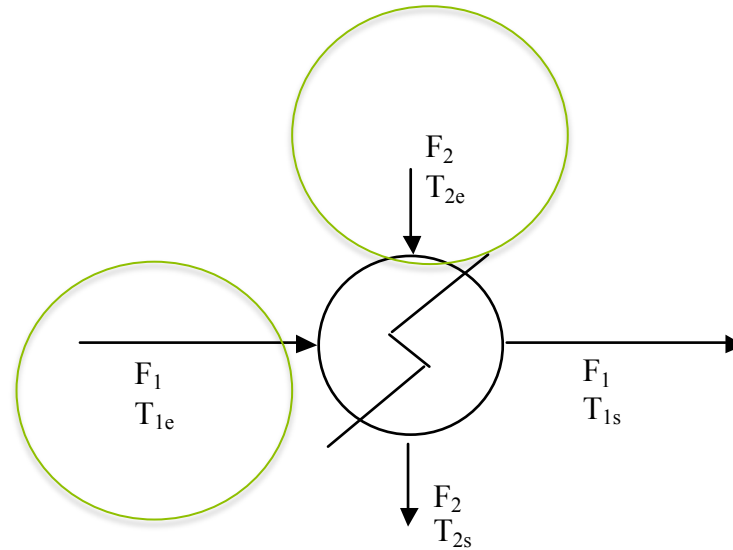
- Specification: Hot stream outlet temperature (dropdown)
- Value: 70 (input) C (dropdown)
- Exchanger area: 10 (input) sqm (dropdown)
- Constant UA: (input) cal/sec-K (dropdown)
- Minimum temperature approach: 1 (input) C (dropdown)

Trocador – HeatX - Simulation

Simulation + Shortcut:

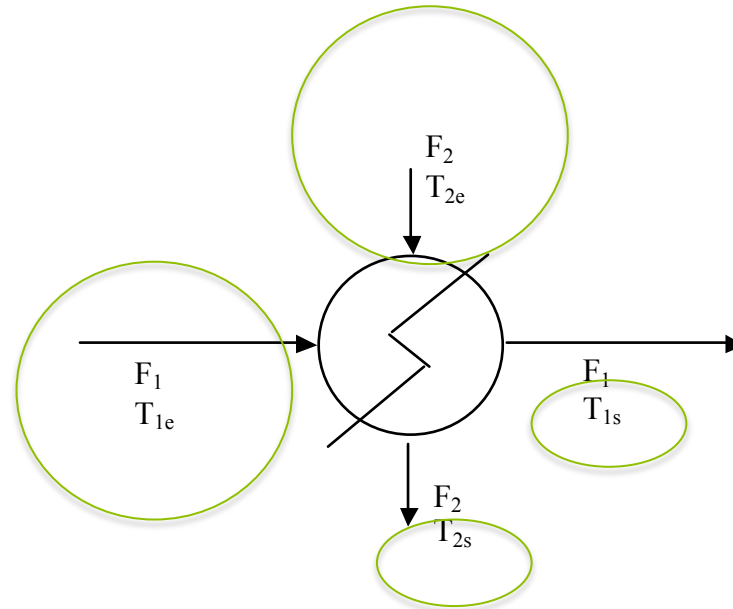
Tem que se fornecer ΔP

Tem que fornecer UA ou um meio de calculá-lo



Trocador – HeatX - Rating

Rating+ Shortcut:



SEPARADORES SIMPLES

Outline

- Separador Matemático
 - Sep
- Flash

Separador Matemático

Separa uma corrente em duas. Módulo Sep e Sep2.

NC balanços de massa

1 balanço de energia

$(N_s - 1) (N_C + 2) + 1$ Graus de Liberdade

Utilidade: estudo de balanços de massa globais

Flash

Cálculo de equilíbrio de fases

Flash: LV

GL: 2 (Q incluído entre as variáveis)

Módulo Flash3: LLV

Módulo decanter: LL