

CEN4417
PROCESS DESIGN I

COMPUTER-AIDED FLOW-SHEETING

Process Simulation Programs

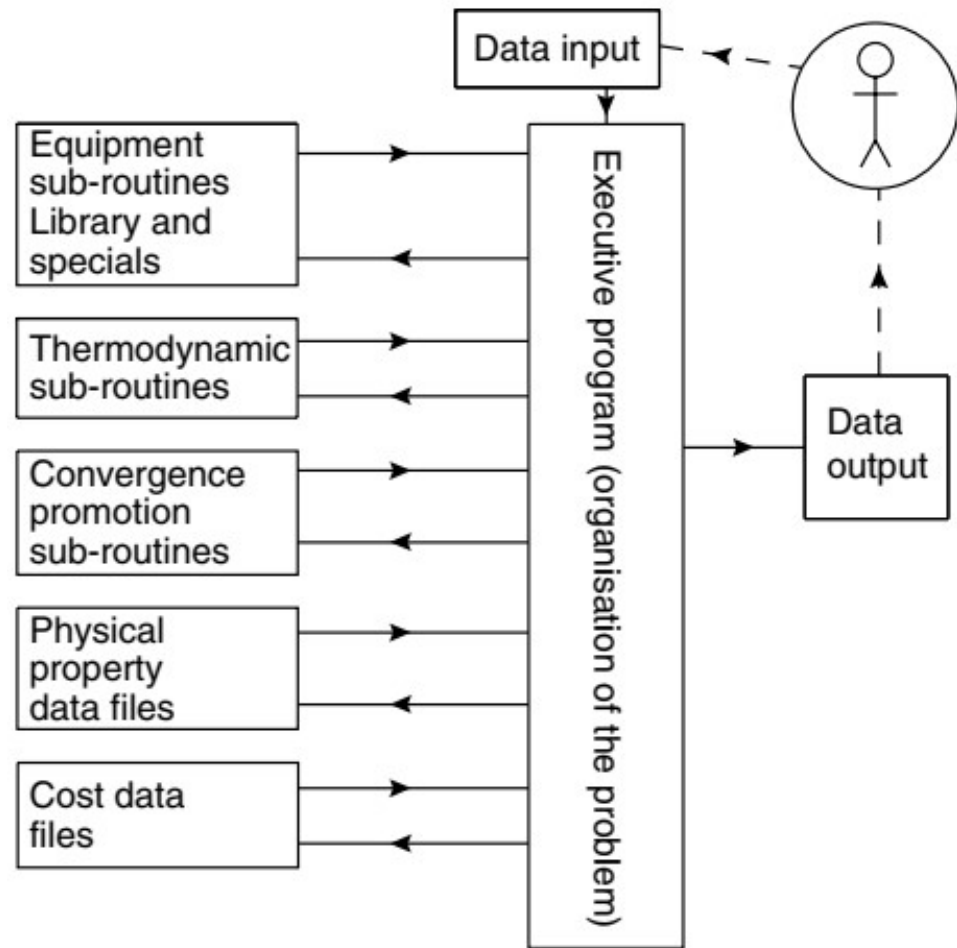
1. Simultaneous, Equation based

- Entire process is described by a set of differential equations, and the equations solved **simultaneously**.

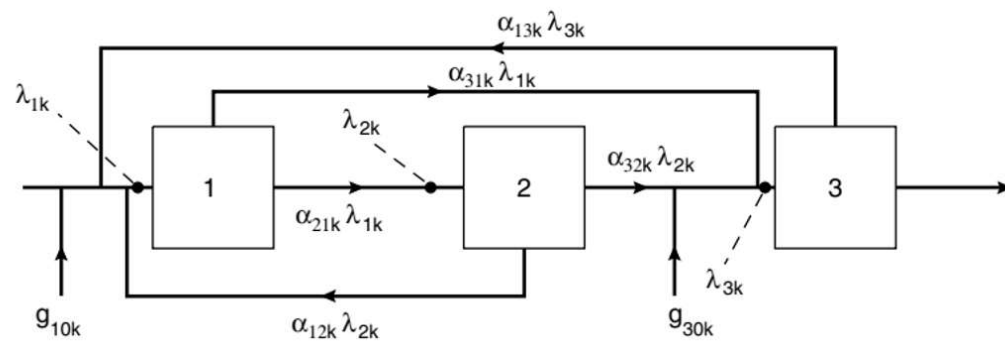
2. Sequential-modular

- Equations describing each process unit (module) are solved module-by-module in a **stepwise** manner.

Structure of a Process Simulation Program



MANUAL CALCULATIONS



$$\lambda_{1k} = g_{10k} + \alpha_{12k} \lambda_{2k} + \alpha_{13k} \lambda_{3k}$$

$$\lambda_{2k} = \alpha_{21k} \lambda_{1k}$$

$$\lambda_{3k} = g_{30k} + \alpha_{32k} \lambda_{2k} + \alpha_{31k} \lambda_{1k}$$

***PIPING & INSTRUMENTATION
DIAGRAMS
(P&IDs)***

- It is a description of the nature of the process.
- The *Piping and Instrument diagram (P&ID)* shows the engineering details of the equipment, instruments, piping, valves and fittings; and their arrangement.
- It is often called the *Engineering Flow-Sheet*, *Engineering Line Diagram* or *Mechanical Flow Diagram (MFD)*.



Information found on a P&ID

Equipment

Backup units
Parallel units

Piping

Size (Use Standard Sizes)
Schedule (Thickness)
Materials of construction


Instruments

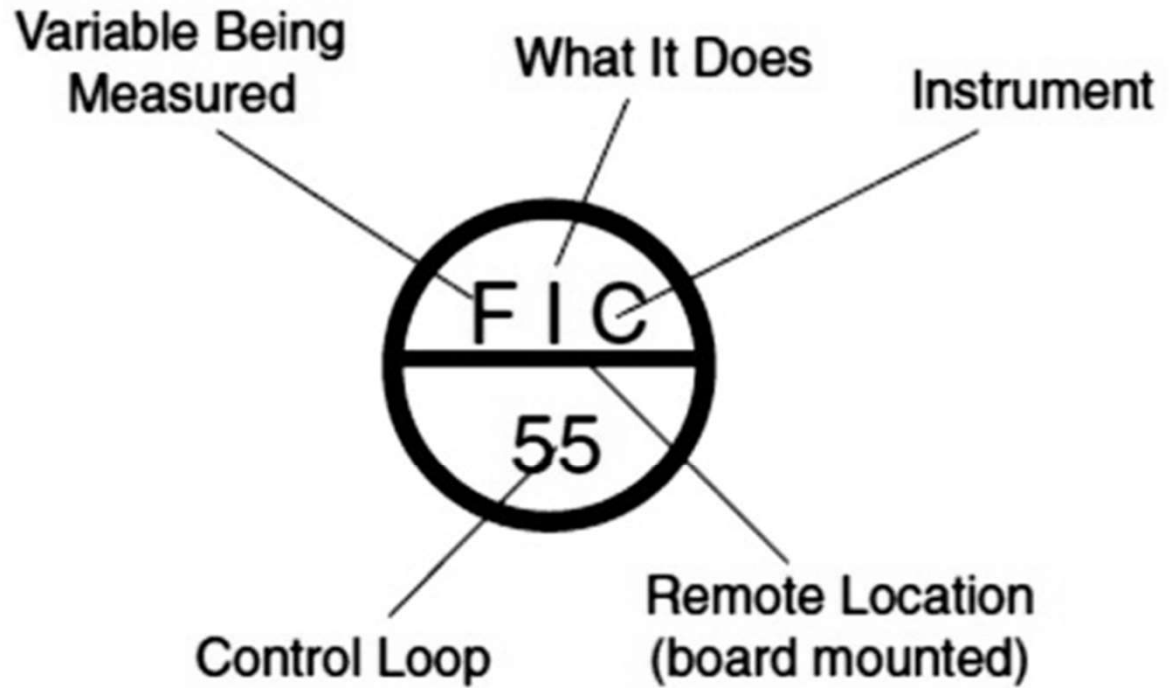
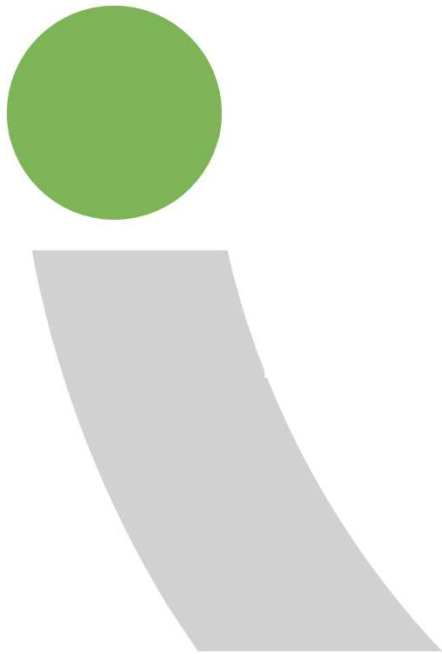
Indicators
Controllers

Utilities

Entrance utilities
Exit utilities

Exclusions from P&IDs

- 
1. Operating conditions T,P
 2. Stream flows
 3. Equipment locations
 4. Pipe routing
 - a. Pipe lengths
 - b. Pipe fittings
 5. Supports, structures, and foundations



REFERENCES

1. Sinnott, R.K. 1999, *Coulson's & Richardson's Chemical Engineering, Volume 6, Chemical Engineering Design*, ButterWorth Heinemann, Oxford.
2. Turton R., Bailie R.C., Whitin W.C., Shaeiwitz J.A. 1998, *Analysis, Synthesis and Design of Chemical Processes*, Prentice Hall, New Jersey.