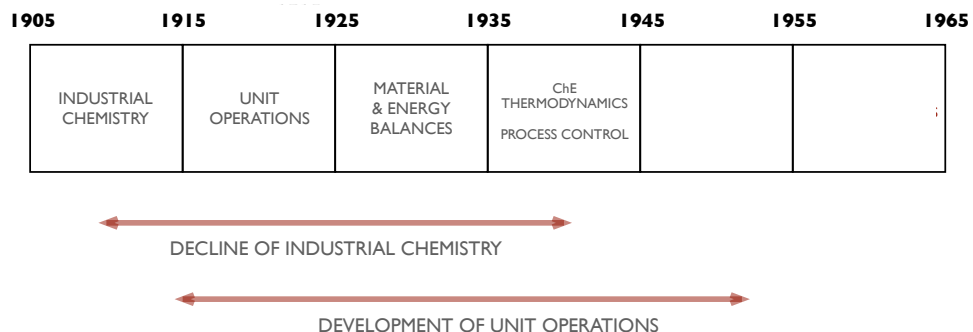


CHBE 303

Computers in Chemical Engineering

History of Chemical Engineering



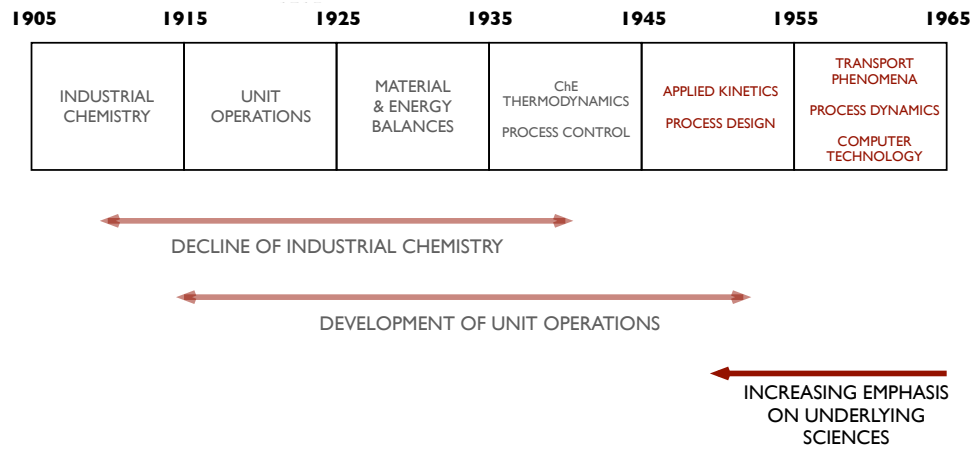
The roots of chemical engineering are in industrial chemistry.

The concept of unit operations was introduced in the 1910's by Arthur D. Little

Every chemical plant consists of a number of "building blocks."

The number of different "building blocks" is not very large.

History of Chemical Engineering



Transformation of chemical engineering from empirical discipline to engineering science coincides with the advent of modern digital computers. Computers allowed us to tackle important problems could not be solved analytically.

CHBE 303

Computers revolutionized the operation of manufacturing plants



CURRENT PROBLEMS IN RESEARCH

Automatic Process Control

Coupling large-scale computers with process systems makes possible the fully automatic process plant.

Ernest F. Johnson

havior provides an index of the system's performance.

A second characteristic of control systems is that they are information processing systems. They obtain information, digest information, and generate information. Just as we use process-flow sheets to keep track of the flows of material and energy, as in Fig. 1, so may we use a signal-flow diagram to keep track of the flow of information in a control system. The signal-flow diagram for the heat-exchange process in Fig. 1 is shown in Fig. 2. There are a variety of types of signal-flow diagrams. The one shown here is a simple block-type diagram.

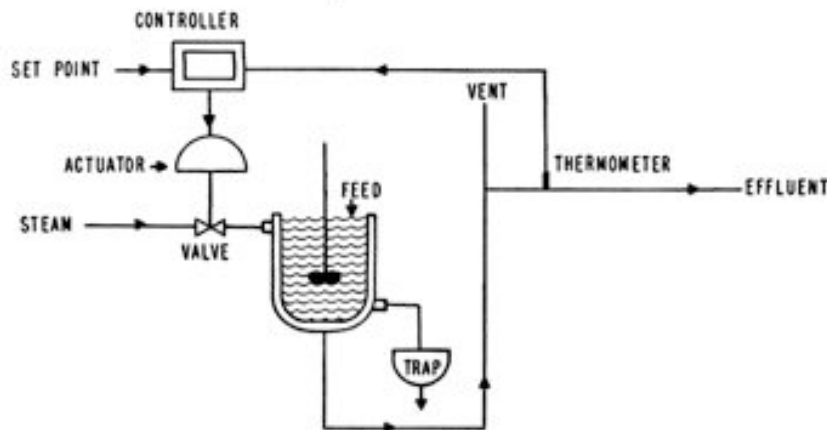
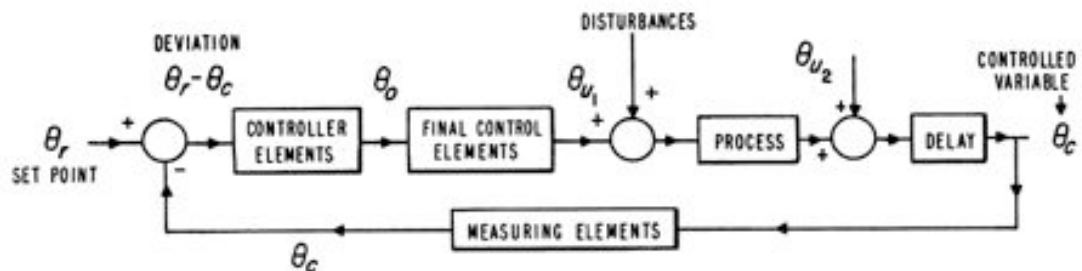


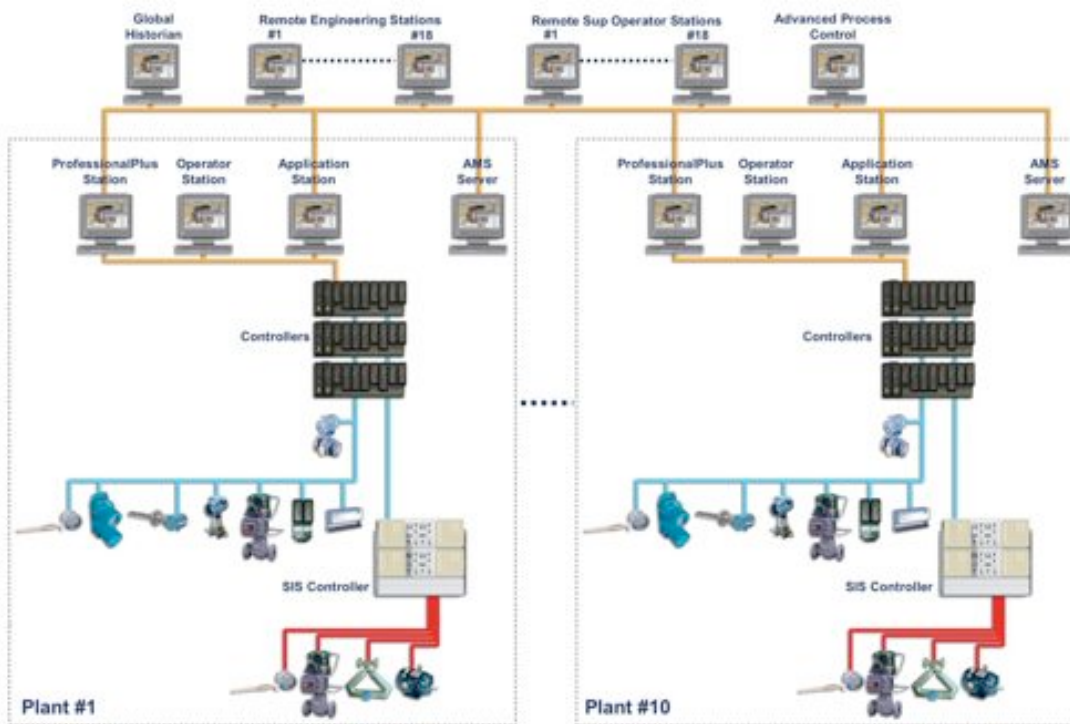
Fig. 1 (left). A simple automatic process control system.

Fig. 2 (below). Signal-flow diagram for simple control system.





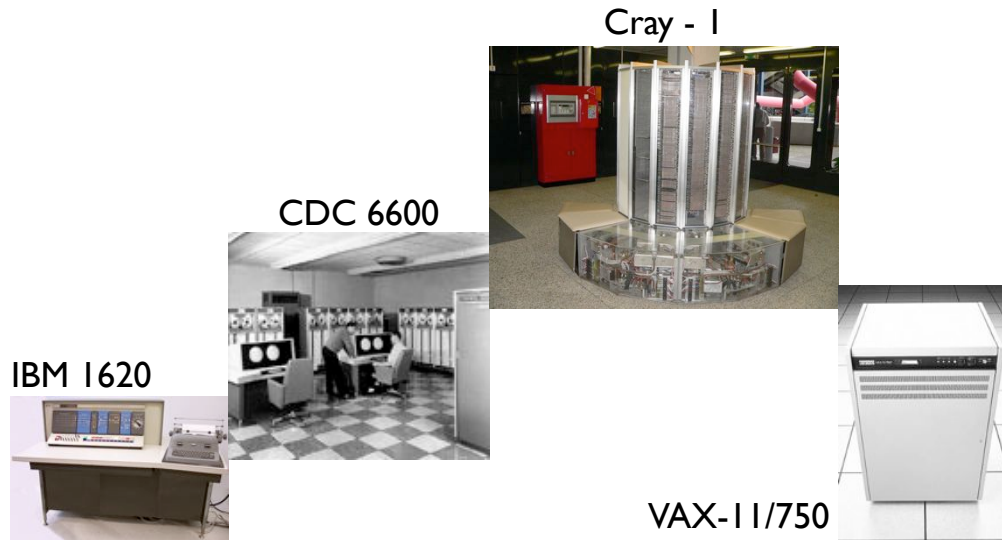
Modern chemical plants are fully instrumented so that all operations can be monitored and controlled by computers. Sensors and final control elements (e.g. control valves) are attached to all processes...



Hierarchical control system of a modern chemical plant



University Education and Research



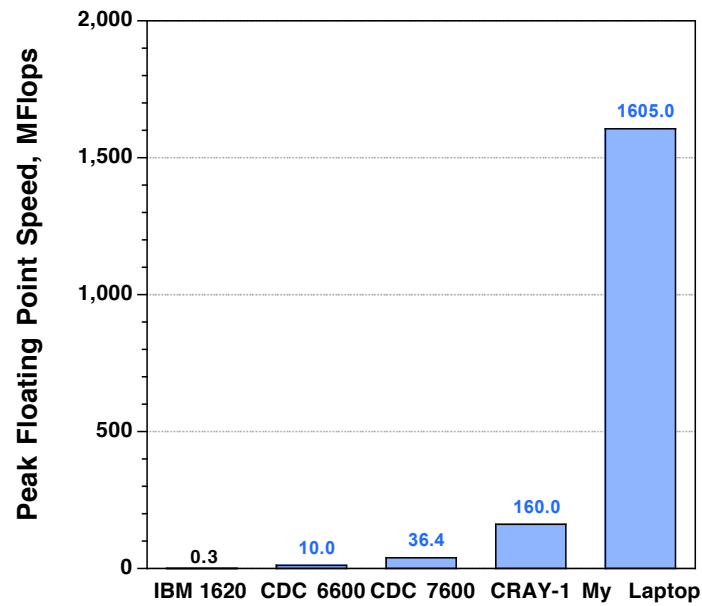
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...personal computers...



CHBE 303

...with Rapidly Increasing Power!

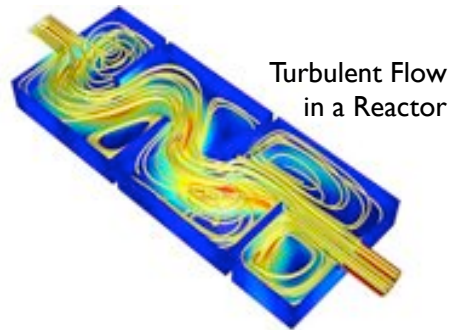
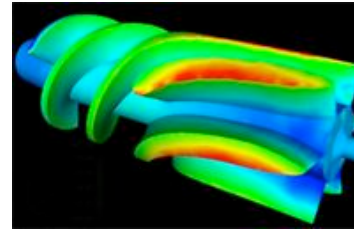
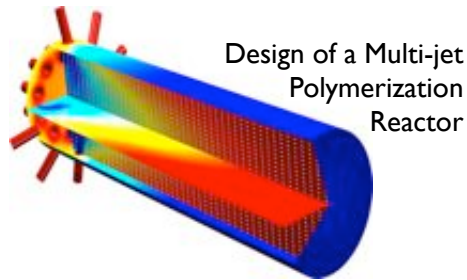


CHBE 303

Why Learn to Program?

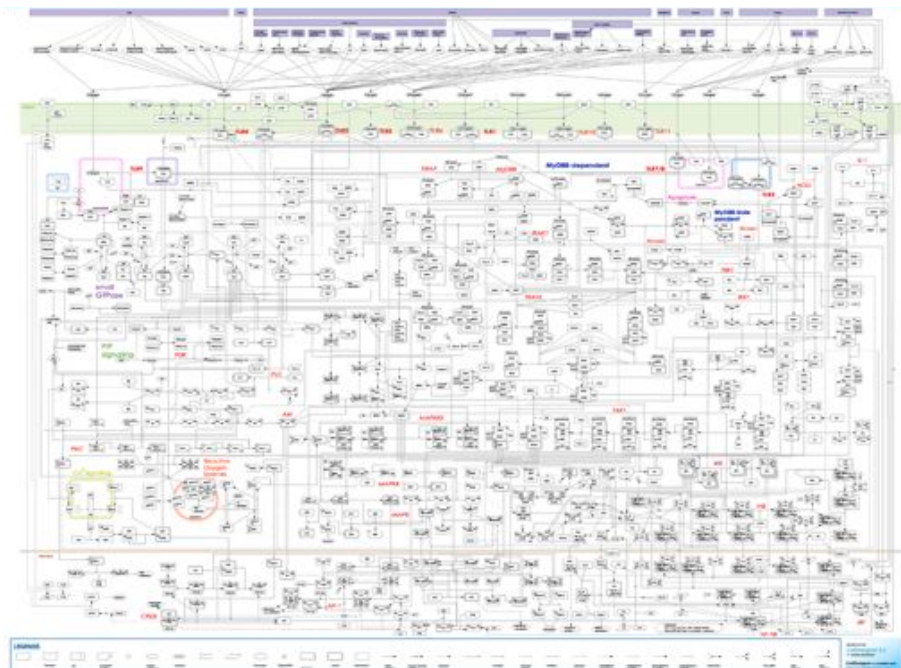
To Better Understand How
Things Work!

Study complex flow patterns to design better reactors or... heart pumps!



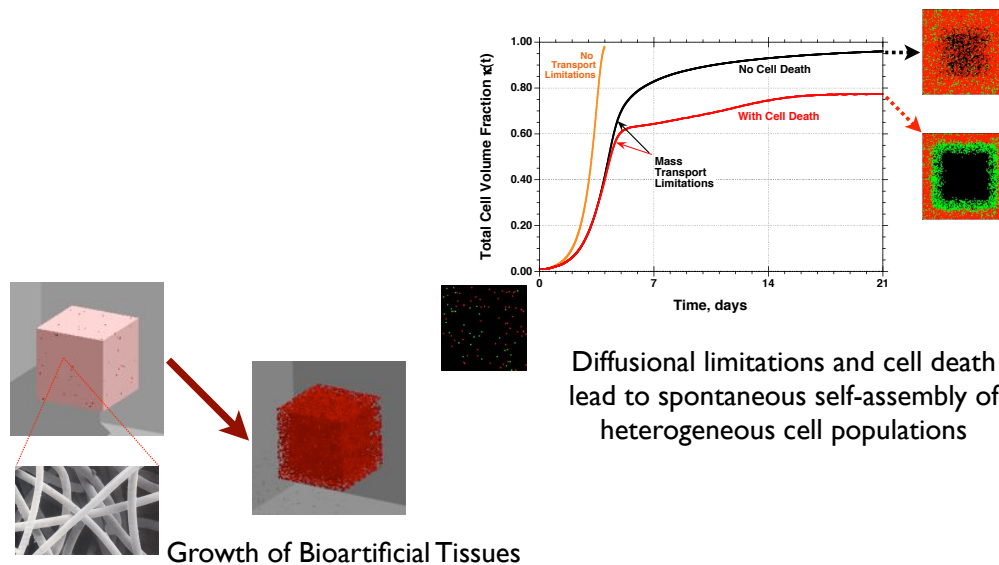
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Study the complex system of biochemical reactions in human cells!



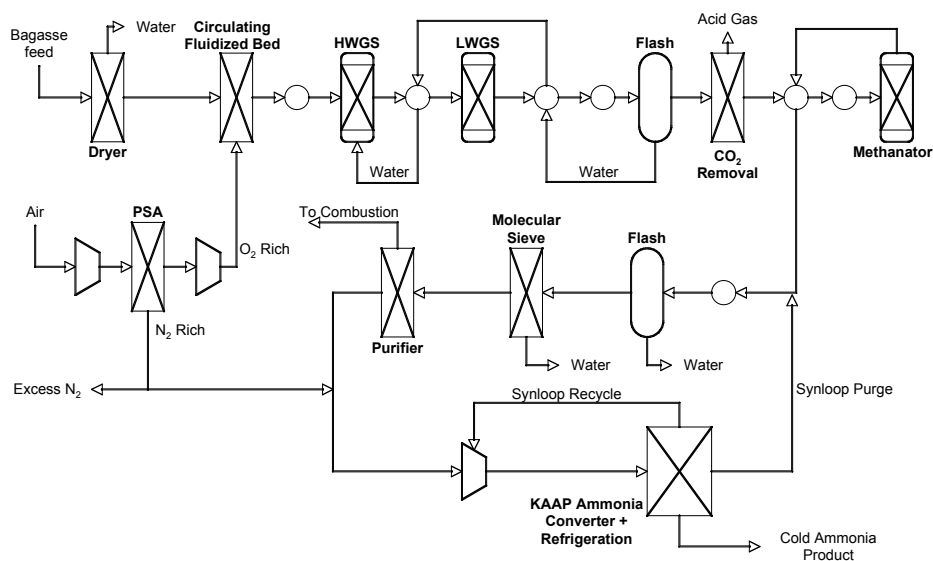
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Simulate and optimize 3-D tissue growth under diffusional limitations



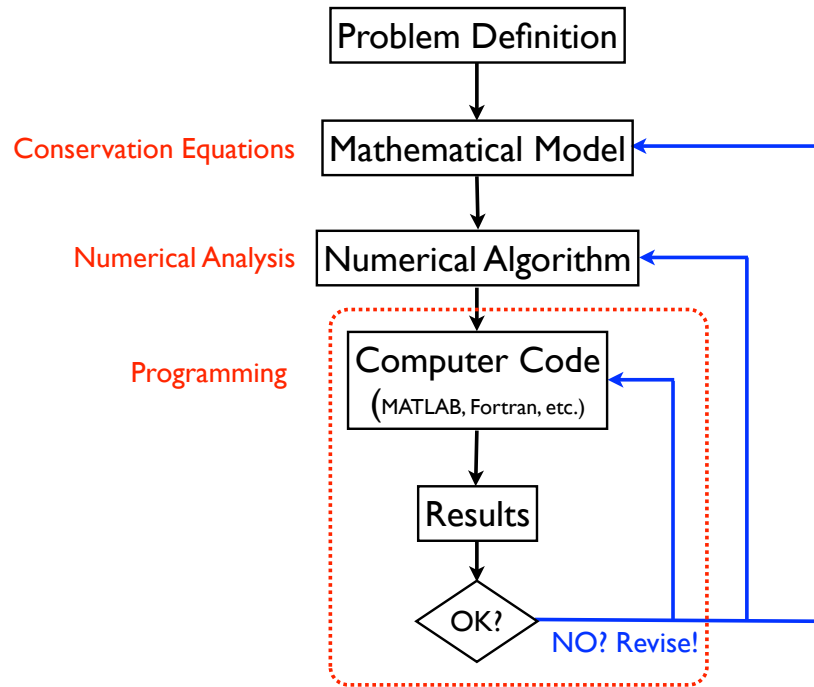
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Design and optimize the operation of large chemical plants



CHBE 303

Computational Engineering



CHBE 303

Computers in Our Curriculum

Programming

Given a problem:

1. Develop an **algorithm** to solve it.
2. Write **pseudocode** for the algorithm.
3. Convert the pseudocode into instructions the computer can understand and execute. This is your **program**.
4. Specify **input data** and **run** the program.
5. Analyze the output. Is the program correct?

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A Small Step...



Mathematica

MATLAB

Maple

Excel

Fortran

C++, Java...

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All You Need Is...

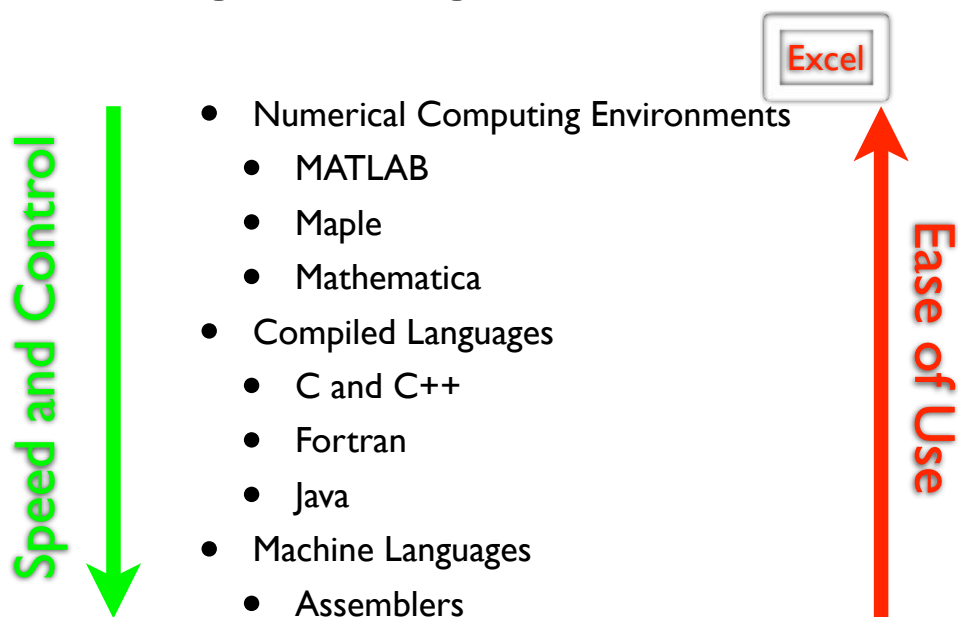
If A implies B,
and
B implies C,
then...

Logic!

(and a programming environment
AND discipline!)

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Programming Environments



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Software Hierarchy

