

THEORETICAL FUNDAMENTALS OF PROCESS ENGINEERING



WL 377
Convection and Radiation

The theoretical fundamentals and laws for understanding process engineering are extremely manifold. Process engineering is an interdisciplinary science and also uses the knowledge of other engineering disciplines. In this chapter, we are presenting a device range with which you can impart the typical basic theoretical learning contents of a process engineering curriculum.

THERMODYNAMICS

For many processes, e.g. thermal process engineering, knowledge of thermodynamics is essential. Understanding a complex process such as, for example, rectification, initially requires the thermodynamic basics of evaporation and condensation. With the help of the laws of thermodynamics the dependencies of the variables temperature, pressure, density and concentration in the system of steam and liquid can be described. Only with this knowledge is it possible to design and construct process engineering apparatus and systems.

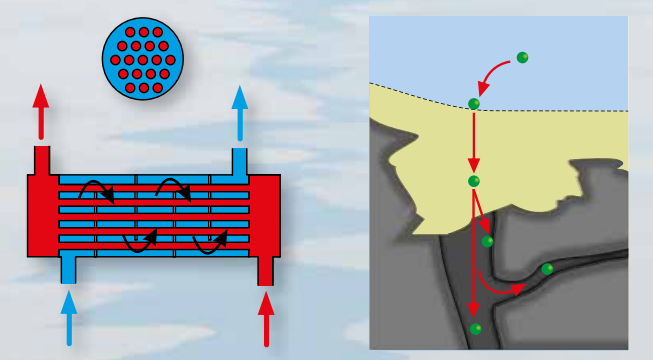


WL 230 Condensation Process

HEAT AND MASS TRANSFER

The speed of production processes is often determined by heat and mass transfer processes. For example, in many chemical and biological mass transformations, it is not the reaction rates that limit the conversion, but the mass transportation processes, which bring about the contact between the reacting agents and the removal of the reaction products. These processes are closely linked with the mass flows, i.e. the actual output of a process. Knowledge of the laws of heat and mass transfer is thus another important basis for designing process engineering systems.

Heat transfer processes are fundamental for the calorific design of process engineering systems. Knowledge of the laws of heat transfer are essential for designing heat transfer surfaces and facilities for heating and cooling. The selection, optimisation and designing of heat exchangers are typical tasks of experts in the process engineering sector.

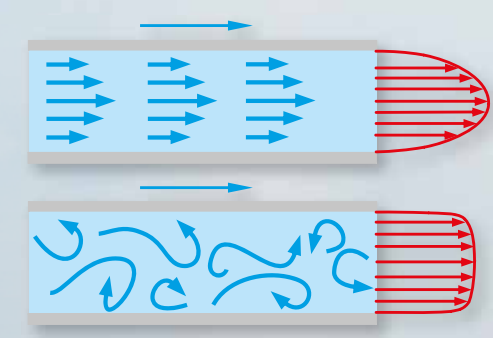


Heat transfer in shell & tube heat exchangers

Mass transfer during adsorption

FLUID MECHANICS

The transportation of substances involved in process engineering often takes place through pipelines. This leads to different flow profiles in conjunction with varying pressure losses, depending on the diameter of the pipelines, flow velocity, substance properties and other influencing factors. The pressure losses in turn influence the necessary output of pumps and compressors. The flow profiles also influence the heat and mass transfer processes.



Laminar and turbulent flow profile in pipelines

MEASURING METHODS

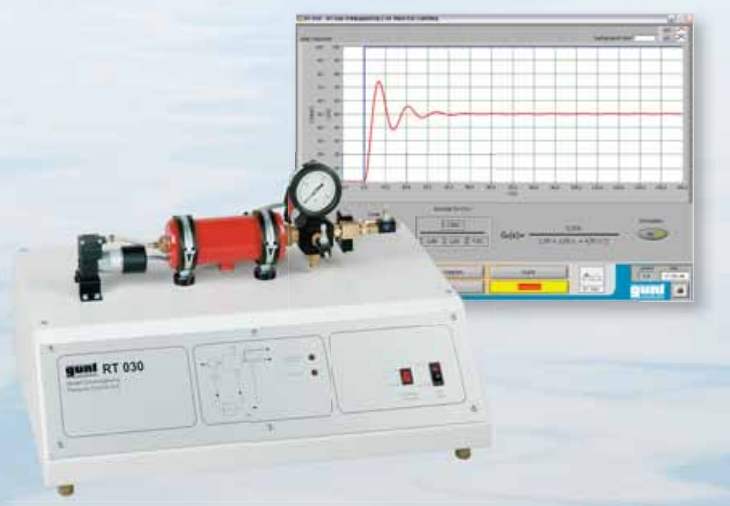
To control processes, first of all it is necessary to record the process variables. The different properties of the process variables, but also of the substances used and the respective aggregate states, make different measuring methods necessary. The different measuring methods can be illustrated in a simple way using the instructional units selected here.



WL 202 Fundamentals of Temperature Measurement

FUNDAMENTALS OF CONTROL ENGINEERING

Mastering industrial-scale process engineering systems without process control engineering is unimaginable. Process variables such as pressure, flow rate or temperature have different properties with regard to their control response. The control response can be approximated and specified with the help of theoretical functions. We have compiled a selection of simple instructional units with which it is easy to impart these theoretical fundamentals of control engineering.



RT 030 Training System: Pressure Control, HSI