

## PRINCIPLES OF MOMENTUM, MASS AND ENERGY BALANCES

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**Keywords:** Steady-state, nonsteady-state, continuous, batch, differential balance, integral balance, accumulation, stress, tensor, residence time, intensity function, birth function, death function

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### Summary

Balance of the entity producing accumulation is, particularly, a basic source of quantitative models of phenomena or processes. The concept of balance of momentum, mass, and energy defined in the chapter is used for elaboration of the algebraic or differential equation which describes processes at the macroscopic or microscopic levels of observation. The procedure of macroscopic balancing for continuous and batch processes is presented. Differential balance equations are formulated for momentum, mass, and energy through the contribution of local rates of transport expressed by principal Newton's, Fick's and Fourier's laws. For description of more complex systems in which strong turbulence of the fluid flow and/or vessel geometry are involved and characterization of the product property is necessary, the population balances are required. Concepts of the age distribution function and the intensity function are introduced and incorporated into the general population balance simultaneously with function of birth and death of balanced entity. Finally, the general microscopic population balance in the geometric space is formulated.

### 1. Introduction

# Principles Of Momentum Mass And Energy Balances

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