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This book presents new accurate and efficient exponentially convergent methods for abstract differential equations with unbounded operator coefficients in Banach space. These methods are highly relevant for practical scientific computing since the equations under consideration can be seen as the meta-models of systems of ordinary differential equations (ODE) as well as of partial differential equations (PDEs) describing various applied problems. The framework of functional analysis allows one to obtain very general but at the same time transparent algorithms and mathematical results which then can be applied to mathematical models of the real world. The problem class includes initial value problems (IVP) for first order differential equations with constant and variable unbounded operator coefficients in a Banach space (the heat equation is a simple example), boundary value problems for the second order elliptic differential equation with an operator coefficient (e.g. the Laplace equation), IVPs for the second order strongly damped differential equation as well as exponentially convergent methods to IVPs for the first order nonlinear differential equation with unbounded operator coefficients.