

Dynamics — A Capsule History		
1666	Newton	Invention of calculus, explanation of planetary motion
1700s		Flourishing of calculus and classical mechanics
1800s		Analytical studies of planetary motion
1890s	Poincaré	Geometric approach, nightmares of chaos
1920–1950		Nonlinear oscillators in physics and engineering, invention of radio, radar, laser
1920–1960	Birkhoff	Complex behavior in Hamiltonian mechanics
	Kolmogorov	
	Arnol'd	
	Moser	
1963	Lorenz	Strange attractor in simple model of convection
1970s	Ruelle & Takens	Turbulence and chaos
	May	Chaos in logistic map
	Feigenbaum	Universality and renormalization, connection between chaos and phase transitions
		Experimental studies of chaos
	Winfree	Nonlinear oscillators in biology
	Mandelbrot	Fractals
1980s		Widespread interest in chaos, fractals, oscillators, and their applications

Table 1.1.1

$$m \frac{d^2x}{dt^2} + b \frac{dx}{dt} + kx = 0 \quad (1)$$

is an ordinary differential equation, because it involves only ordinary derivatives dx/dt and d^2x/dt^2 . That is, there is only one independent variable, the time t . In contrast, the heat equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$