

<<隐函数定理>>

图书基本信息

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## 内容概要

The implicit function theorem is, along with its close cousin the inverse function theorem, one of the most important, and one of the oldest, paradigms in modern mathematics. One can see the germ of the idea for the implicit function theorem in the writings of Isaac Newton (1642-1727), and Gottfried Leibniz's (1646-1716) work explicitly contains an instance of implicit differentiation.

While Joseph Louis Lagrange (1736-1813) found a theorem that is essentially a version of the inverse function theorem, it was Augustin-Louis Cauchy (1789-1857) who approached the implicit function theorem with mathematical rigor and it is he who is generally acknowledged as the discoverer of the theorem. In Chapter 2, we will give details of the contributions of Newton, Lagrange, and Cauchy to the development of the implicit function theorem.

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## 章节摘录

版权页：插图： The picture we would like to see for the curve  $(t(s), x(s))$  along which (4.10) holds should resemble that in Figure 4.1 (a). It would be even better if the curve resembled that in Figure 4.1(b), because in that case we could parameterize the curve by  $t$  itself. On the other hand, it is conceivable that the solution set of  $H(t, x) = 0$  might look like that in Figure 4.2 where, starting from a zero of the form  $H(0, x_0)$ , we can never arrive at a zero of the form  $H(1, x_1)$ . Notice that there are four types of bad behavior for  $\{(t, x) : H(t, x) = 0\}$  in Figure 4.2: (1) A curve starts at  $t=0$ , but doubles back without ever getting to  $t = 1$ , (2) a curve becomes unbounded in  $x$ , (3) a curve reaches a bifurcation point where curves cross, and (4) a curve comes to a dead end where it cannot be continued. All of these instances of bad behavior are possible; nonetheless they all can be ruled out by imposing some simple hypotheses and applying the implicit function theorem. To illustrate the ideas, we first state a theorem in which we can show that the curve  $H(t(s), x(s)) = 0$  has the nice form shown in Figure 4.1(b). Theorem 4.2.1 Let  $U$  be an open subset of  $\mathbb{R}^n$ . Suppose that  $H$  is continuously differentiable in an open set containing  $[0, 1] \times U$ , that the function  $F_0$  given by  $F_0(x) = H(0, x)$  has a simple zero  $x_0$  with the 1764 award given by the Paris Academy of Sciences for his paper on the libration of the moon. A basic result in celestial mechanics is Kepler's equation  $E = M + e \sin(E)$ , (2.15) where  $M$  is the mean anomaly,  $E$  is the eccentric anomaly, and  $e$  is the eccentricity of the orbit. We will describe these quantities in more detail later. For the moment, we note that  $M$  and  $e$  should be considered to be the quantities that can be measured and that  $e$  is assumed to be small. One of Lagrange's theorems, now called the Lagrange Inversion Theorem, gave a formula for the correction that must be made when, for some function  $f$ ,  $f(M)$  is replaced by  $f(E)$ .

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在数学中，隐函数定理是一个描述关系以隐函数表示的某些变量之间是否存在显式关系的定理。

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