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Taylor polynomials of implicit functions, of inverse functions, and of solutions of ordinary differential equations. (English)

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Suppose a real function $f : I \to$ is n-times differentiable in an interval I containing the point x_0. Then the polynomial

$$T_n(f, x, x_0) := \sum_{k=0}^{n} \frac{f^{(k)}(x_0)}{k!}(x - x_0)^k 1$$

is called the Taylor polynomial of order n of f.

If a function f is explicitly given then (1) is an algorithm for an iterative calculation of the Taylor polynomials. The calculation of Taylor polynomials for such functions is implemented in most computer algebra systems available. In applications, functions often are given only implicitly by an equation $F(x, y) = 0$, where $y = y(x)$ is considered to be a function of the variable x. In this paper a simple and efficient algorithm to calculate Taylor polynomials of implicit functions, of inverse functions, and of solutions of ordinary differential equations of first and higher orders, are presented. The author gives implementations in the computer algebra system DERIVE that demonstrate the efficiency of the algorithms in practice.

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Keywords : Taylor polynomials; implicit functions

Classification:

- 41-04 Machine computation, programs (approximations and expansions)
- 68Q40 Symbolic computation, algebraic computation
- 68-04 Machine computation, programs (computer science)
- 30B10 Power series (one complex variable)
- 30-04 Machine computation, programs (functions of a complex variable)