1014-34-1580 **David C. Carothers***, Dept. of Mathematics and Statistics, James Madison University, Harrisonburg, VA 22801, and **G. Edgar Parker**. *Pervasiveness of Polynomial Differential Equations.* Preliminary report.

A system of ordinary differential equations $y_i' = P_i(y_1, \cdots, y_n); y_i(0) = a_{i0}, i = 1, \cdots, n$ where each P_i is a polynomial is called a *polynomial system*, and functions that are components of the solution to such a system are called *projectively polynomial* functions. Straightforward arguments show that the elementary functions are projectively polynomial. We show that any first order system $u_i' = f_i(u_1, \cdots, u_k)$ where each f_i is formed by combining projectively polynomial functions under composition, inverse, and polynomial operations may be transformed into a polynomial system, thereby including the very broad group of systems formed by taking algebraic combinations of elementary functions. Such systems are amenable to efficient numerical techniques, may be decoupled using Gröbner basis algorithms, and are subject to a new a-priori error bound due to Paul G. Warne. The observations on composition, addition, and multiplication of projectively polynomial functions enable a representation of the algebra of analytic function as classical algebraic structures. (Received September 28, 2005)