# ON THE CHOICE OF COORDINATE FUNCTIONS

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## 1. INTRODUCTION

Numerically, there are two independent aspects to the problem of solving (partial) differential and integral equations computationally. On the one hand, it is necessary to have results concerning the convergence, stability and accuracy of various classes of methods such as finite difference methods for initial value problems, finite element methods for elliptic partial differential equations, shooting methods for two-point boundary value problems, etc. The general philosophy and expertise of numerical problem solving is based on such information. On the other hand, for a specific equation which arises in an application, it is necessary to distinguish between the various algorithms which can be constructed. For the particular equation under examination, the aim is not simply to apply any appropriate algorithm but to use the algorithm best suited to the task in hand. Thus, the requirements of the latter differ considerably from that of the former.

In fact, the success of any algorithm constructed for a specific problem will depend heavily on the extent to which its design exploits the mathematical characteristics of the problem under examination. Some specific examples are: the use of the boundary integral method to solve potential problems defined on irregularly shaped regions; the use of the inversion formulas to solve Abel integral equations; the numerical stability of modified Gram-Schmidt; Fourier methods on a regular grid; sparse matrix computations; parallelism in algorithm construction.

In situations where the starting point for the construction of a