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ODE Estimation-statistical Properties and Computational Problems

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Abstract

There is some point to recalling the large sample behaviour of standard parametric estimation problems if only to emphasise that the ODE problem is strictly different even if some solution methods employ similar techniques. Differences occur because the manifold of model responses depends not only on the explicit model parameters but also on the strategy employed to take account of the intrinsic degrees of freedom in the ODE specification. This is an aspect of the problem of introducing coordinates into a manifold and it can have direct bearing on the domain of attraction of the solution of the resulting estimation problem. Solution methods fall into two classes, embedding and simultaneous, depending on the strategy adopted for taking account of the DE degrees of freedom. They can be contrasted as explicit and implicit or data driven embeddings. Natural questions are consistency and equivalence. The embedding methods draw on solution techniques available for related boundary problems. It is possible to introduce optimal embeddings, and relatively easy to incorporate adaptive strategies. The simultaneous method introduces the discretized ODE as a set of equality constraints on the problem objective. The Lagrange multipliers provide an interesting link to a stochastic DE which promises some useful information. Adaptive strategies become more difficult without good a priori information.