# Optimal Prediction Methods for Nonlinear PDEs

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ABSTRACT

Optimal prediction methods compensate for a lack of resolution in the numerical solution of time-dependent differential equations through the use of prior statistical information. This is done by reducing the large (possibly infinite) dimensionality of the original problem. A partial differential equation, e.g., will be transformed into an arbitrarily small system of ordinary differential equations.

Focusing on nonlinear PDEs, we will derive the first-order optimal prediction equations, assuming that the additional information about the PDE is given in the form of a prior invariant measure on the space of initial data.

We will then explain how to use field-theoretical perturbation methods in order to transform the optimal prediction equations into a closed system of ODEs and demonstrate these methods in approximating solutions of nonlinear Schroedinger-type equations.