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CONSTRUCTION OF GROUP-INVARIANT SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

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Abstract. The Lie group method for construction of group-invariant solutions of partial differential equations is presented. The method is applied to a system of two coupled nonlinear Schrödinger equations. The so called reduced system of equations for translationally invariant solutions is obtained. Group-invariant solutions for the degenerate case of two decoupled Schrödinger equations are found.

1. Introduction

A symmetry group of a given system of differential equations is a local group of transformations acting on the space of the independent and dependent variables having the property to transform each solution to a solution of the system as well. The group-invariant solutions are the fixed points of this action. The method for construction of group-invariant solutions is based on the knowledge of the invariants of the symmetry group of the considered system of differential equations. Any group-invariant solution can be obtained as a solution of the so-called *reduced system of differential equations* (RSEs). It is particularly important for applications that in comparison with the original system the RSEs has fewer independent variables. If the number of the group parameters are one less than the number of the independent variables in the initially given system of *partial differential equations* (PDEs), then the RSEs consists of ordinary differential equations. It means that as a result of the reduction process the original system of PDEs is replaced by the much simpler system of ordinary differential equations.

In Section 2 we introduce the basic steps of the Lie group method for construction of group-invariant solutions of PDEs. In the next Section 3 we apply this method