

# Abstract

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## **New solutions for solving the problem of particle trajectories in linear deep-water waves via Lie-group method**

The nonlinear equations of the two-dimensional inviscid incompressible fluid in a constant gravitational field describing the wave propagation on the water surface are considered. The Lie-group method has been applied for determining symmetry reductions of the system of partial differential equations. Lie-group method starts out with a general infinitesimal group of transformations under which the given partial differential equations are invariant. The determining equations are a set of linear differential equations, the solution of which gives the transformation function the infinitesimals of the dependent and independent variables. After the group has been determined, a solution to the given partial differential equations may be found from the invariant surface condition such that its solution leads to similarity variables that reduce the number of independent variables of the system. Effects of the wavelength  $k$  and time  $t$  on the particle path have been studied and the results are plotted.