

# Abstract

In this research, a systematic application of the group analysis method for modeling fluids with internal inertia is presented. The equations studied include models such as the non-linear one-velocity model of a bubbly fluid (with incompressible liquid phase) at small volume concentration of gas bubbles (Iordanski (1960), Kogarko (1961), Wijngaarden (1968)), and the dispersive shallow water model (Green & Naghdi (1976), Salmon (1988)). These models are obtained for special types of the potential function  $w(\dots, \dots, s)$  (Gavrilyuk & Teshukov (2001)). The main feature of the present research is the study of the potential functions with  $w_s \neq 0$ . The group classification separates these models into 73 different classes.