

Symmetry analysis of a variable coefficient nonlinear diffusion equation

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The focus of this paper is the variable coefficient nonlinear diffusion equation of the form $u_t = (x^\mu u^{-4/3} u_x)_x$ which has various applications in mathematical physics. Point transformations that form a continuous Lie group of transformations or Lie point symmetries which leave the equation form invariant were then studied.

The generator $X = \xi^1(t, x, u)\partial_t + \xi^2(t, x, u)\partial_x + \eta(t, x, u)\partial_u$ is a Lie point symmetry of the equation if

$$X^{[2]} \left\{ u_t - \mu x^{\mu-1} u^n u_x - n x^\mu u^{n-1} u_x^2 - x^\mu u^n u_{xx} \right\} \Big|_{u_t - (x^\mu u^{-4/3} u_x)_x = 0} = 0,$$

where, $X^{[2]}$ is a second-prolongation of X . This is the determining equation of the Lie point symmetries of the equation under consideration.

Lie point symmetries admitted by this equation are used to reduce the number of independent variables in the equation by one called symmetry reduction and this has led to obtain group-invariant solutions that do not appear in the literature.

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