Group analysis of reaction-diffusion models

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Abstract. Diffusion type systems of nonlinear partial differential equations

$$\begin{aligned} \frac{\partial u}{\partial t} &= f(u,v) + A\frac{\partial^2 u}{\partial x^2} + \frac{\partial}{\partial x}\left(\phi(u,v)\frac{\partial v}{\partial x}\right), \\ \frac{\partial v}{\partial t} &= g(u,v) + B\frac{\partial^2 v}{\partial x^2} + \frac{\partial}{\partial x}\left(\psi(u,v)\frac{\partial u}{\partial x}\right), \end{aligned} \tag{1}$$

known as reaction-diffusion models, are used for investigating propagation of nonlinear waves in physical, chemical and biomedical phenomena (see, e.g. [1]). Here A, B are arbitrary parameters, $f(u,v), g(u,v), \phi(u,v)$ and $\psi(u,v)$ are arbitrary functions.

The system

$$\begin{aligned} u_t &= f(u) - (uc_x)_x \\ c_t &= -g(c,u) \end{aligned} \tag{2}$$

used as a model for describing tumour growth is a particular case of the reaction-diffusion system (1).

This talk is dedicated to investigation of nonlinear self-adjointness of the system (1). A group invariant solutions of the system (2) is also presented.

Keywords: Reaction-diffusion models, Group analysis, Exact solutions.

References

[1] M. A. Tsyganov, V. N. Biktashev, J. Brindley, A. V. Holden, and G. Ivanitsky, "Waves in systems with cross-diffusion as a new class of nonlinear waves," *Uspekhi Fizicheskikh Nauk*, vol. 177(3), pp. 275–300, 2007. English transl., *Physics - Uspekhi*, 50(3), 263-286, 2007.