Determining the class of exact particular solutions for viscoelastic mixtures.

Jalilova R.Q.

Jalilova Rahima Qurbanovna - PhD in Physical and Mathematical Sciences, dosent, the teacher of the Department of "Computational Mathematics and Informatics" of the Azerbaijan State Pedagogical University, Baku

Abstract: *The investigation of the process of localization disturbances are passed, which causing by LS-the regime with aggravation in gas-liquid mixture.*
Keywords: *equation of Relay, localization of disturbance, the wave processes in two-phase systems.*

Определение класса точных частных решений для вязкоупругих смесей.

Джалилова Рахима Курбановна - Доктор философии по физико-математическим наукам, доцент, педагог кафедры "Вычислительной математики и информатики" Азербайджанского Государственного Педагогического Университета, г. Баку

Аннотация: В статье проведено исследование процесса локализации возмущений, вызванной LS-режимом с обострением , при фильтрации газожидкостной смеси. Рассматривается движение жидкости с мелкодиспергированным в ней газом в пористой среде в следующих случаях : а) при наличии источника (стока), б) при переменной проницаемости, в) при равномерно распределенном дебите. В процессе исследований доказано, что происходит локализация возмущений, вызванной LS - режимом с обострением в газожидкостной смеси в пористой среде. Скорость увеличивается в режиме с обострением вблизи центра симметрии, а вне этой области стремится к постоянному распределению скорости.

Ключевые слова: уравнение Релея, локализация возмущений, волновые процессы в двухфазных системах.

Submit the action of liquid with small-dispersion in its gas in the porous environment .The equation of the action of single-measure stream of gas-oil mixture with reckoning of the inertial members has the following view: [3,43]

$$\frac{1}{m}\frac{\partial \omega}{\partial t}+\frac{1}{m}\left(\omega\frac{\partial}{\partial x}\left(\frac{\omega}{m}\right)\right)=-\frac{1}{\rho}\frac{\partial p}{\partial x}-\frac{1}{\rho}\frac{\mu}{k}\omega \quad (1)$$

where t-time, x-co-ordinate, w-speed of the action of mixture , ρ -compactness of mixture ,P-pressure, μ - viscosity, k-pervious, m-porosity

It is possible to neglect the disturbance with the interaction among the bubbles and submit the action of each bubble independently from other bubbles for condition that the distance between the bubbles of gas bigger of their radius and essential smaller of the length of wave. On the foundation of the equation of Relay and elementary direct of homogeny model, which connects radius of bubble R with compactness ρ -[2,283] ,the equation is written in view:

$$\sigma P=a_0^2\sigma\rho+\frac{4}{3}\frac{\nu}{(1-\varphi_0)\varphi_0}\frac{d\sigma\rho}{dt}+\frac{R_0^2}{3(1-\varphi_0)\varphi_0}\frac{d^2\sigma\rho}{dt^2} \quad (2)$$

where R_0 - balance radius of gas bubble , ν - kinetic viscosity,

$\varphi_0=\frac{4}{3}\pi R^3 N\rho$ - the actually volume gas-substance, N-numerous of bubbles in one mass of mixture

$a_0^2=P_0(1-\varphi_0)\varphi_0\rho$ - expression for low-frequency approximate of the speed of sound in two-phase space. The porous space is little compressibility:

$$m \approx \alpha\rho; \alpha = \frac{m_0}{\rho_0} + \beta\alpha_0^2 - \frac{\beta P_0}{\rho_0} \qquad (3)$$

where $\beta \ll 1$ -coefficient of compressibility of porous space.

Using the methods of not linear wave dynamic, and so the row of transformations, connecting compactness ρ with speed of mixture w, we get one equation concerning w, showing the action of gas-liquid mixture in the porous space [3].

$$\frac{\partial w}{\partial t} + \frac{w}{\alpha\rho_0}\frac{\partial w}{\partial x} - \eta\frac{\partial^2 w}{\partial x^2} + \chi\frac{\partial^3 w}{\partial x^3} + \frac{\alpha\mu}{2k}w = 0 \qquad (4)$$

where $2\eta = \frac{4}{3}\frac{\nu}{(1-\varphi_0)\varphi_0}; 2\chi = \frac{1}{3}\frac{R_0^2 a_0}{(1-\varphi_0)\varphi_0}$

In this case the coefficient has the meaning of compactness viscosity, appearing with reckoning of disciplinal losses on the boundary of separation phases. The member from the third derivative describes the influence of the dispersion effects for the action of two-phase mixture in whole. It is famous that in the process of the spreading of disturbances ,dissipation balances the un linear effects and assists for the installation of the stationary forms of the wave.

Give some he first limited spreading of speed:

$$w(x,0) = w_0(x) \qquad (5)$$

Auto model decisions of the mission (4)-(5) are investigated:

$$w(x,t) = g(t)\theta(\xi), \text{ where } \xi = x/\varphi(t) \qquad (6)$$

Putting (6) in (4) determinations the functions:

$$g(t) = \left(1 - \frac{t}{\tau}\right)^{2/3} \qquad \varphi(t) = \left(1 - \frac{t}{\tau}\right)^{1/3} \qquad (7)$$

where τ -arbitrary parameter of devising of variable. The mission has the auto model decision:

$$w(x,t) = \left(1 - \frac{t}{\tau}\right)^{-2/3}\theta(\xi) \quad , \quad \xi = x(1 - \frac{t}{\tau})^{-1/3} \qquad (8)$$

where $\theta(\xi)$ -the decision of equation

$$\chi \frac{d^3\theta}{d\xi^3} + \frac{1}{\alpha\rho_0}\theta\frac{d\theta}{d\xi} + \frac{1}{3\tau}\xi\frac{d\theta}{d\xi} + \frac{2}{3\tau}\theta = 0 \qquad (9)$$

So $x = \xi\left(1 - \frac{t}{\tau}\right)^{1/3}$ then $0 \le t \le tf$, half width of area of spreading disturbance is shorten.

Decision w(x ,t) is the decision of the regime with aggravation. In this case half width of the first division $w_0(x)$ bigger than half width of decision w(x, t) when $0 \le t \le tf$ .We see the localization of disturbances. When $\xi \to \infty$ then decision of equation (9) has asymptotic [3,44]:

$$\theta \to c\xi^{-2} \qquad (10)$$

From (10) and (6) we get that the main member of asymptotic decomposition of the speed with $x \to \infty$

$$w(x,t) \to cx^{-2} \qquad (11)$$

does not depend on time .It shows on the localization of disturbances; speed increases in the regime with aggravation in shortening area near the centre of symmetry, but out of that area it aspires to the constant spreading of speed, it means to definite of the following expression(11).

Analogous investigations of the process of localization disturbances which causing of LS-the regime with aggravation in gas-liquid mixture are concluded with reckoning of the action of source.

The member which takes into consideration the action of source in the equation of inseparable is inserted:

$$\frac{\partial(\rho m)}{\partial t} = -\frac{\partial(\rho w)}{\partial x} + q(w) \qquad (12)$$

The equation which descriptions the action of gas-liquid mixture in porous spare is written in the following view:

$$\begin{aligned} &\frac{\partial w}{\partial t} + \frac{w}{\alpha\rho_0}\frac{\partial w}{\partial x} - \eta\frac{\partial^2 w}{\partial x^2} + \chi\frac{\partial^3 w}{\partial x^3} + \frac{\alpha\mu}{2k}w + \\ &\frac{q(w)}{2} - \eta\alpha\frac{\partial q(w)}{\partial(x)} = 0 \end{aligned} \qquad (13)$$

The auto model decisions of missions (13),(5) in view (6) are investigated.

Submit the case when the source with the degree mode depends on w:

$q(w) = q_0 w^x + \sigma_0 w$

Putting (6) in equation (13) when $\eta = 0$ determinates the function g(t) and $\varphi(t)$ with the formulas (7) where $\theta(\xi)$ -the decision of equation.

$$\chi \frac{d^3\theta}{d\xi^3} + \frac{1}{\alpha\rho_0}\theta\frac{d\theta}{d\xi} + \frac{1}{3\tau}\xi\frac{d\theta}{d\xi} + \frac{2}{3\tau}\theta + q_0\frac{\theta^{5/2}}{2} = 0 \qquad (14)$$

We will look for the equation answering the following boundary conditions:

$$\frac{d^3\theta}{d\xi^3} - _{\xi\to\infty} > 0, \theta\frac{d\theta}{d\xi} - _{\xi\to\infty} > 0, \theta^P - _{\xi\to\infty} > 0, P > 1$$

when $\xi \to \infty$ then decision of equation has asymptotic(10).Therefore the main member of asymptotic decomposition of the speed does not depend on time [4, 64].

Now submit the auto model decision of the mission with variable of pervious. A law of inflexion of pervious on layer applies middle-aged:

$k(x) = k_0\left(\frac{x}{h}\right)^j$ where k_0 -coefficient of pervious for x=h, h-capacity of layer. It is not difficult to persuade if j=3 then the decision is auto model and has the view(8).Function satisfies to ordinary differential equation:

$$\chi \frac{d^3\theta}{d\xi^3} + \frac{1}{\alpha\rho_0}\theta\frac{d\theta}{d\xi} + \frac{1}{3\tau}\xi\frac{d\theta}{d\xi} + \left(\frac{2}{3\tau} + \frac{\mu}{2k_0}\frac{h^3}{\xi^3}\right)\theta + q_0\frac{\theta^{5/2}}{2} = 0$$

We see $\theta(\xi)$ has asymptotic if $\xi \to \infty$ it means goes on the localization of disturbances[4,65].

Submit the mission (13),(5)by setting debit which distributions follow the square of deposit ;except the general action of mixture from each element of volume layer it is possible to productive the selection of mixture for setting intensive.

In that case the compactness of debit determinations by formula q/x or w^x / x .It is not difficult to persuade for $\gamma = 2$ the decision is auto model. The equation concerning $\theta(\xi)$ has the following view:

$$\chi \frac{d^3\theta}{d\xi^3} + \frac{1}{\alpha\rho_0}\theta\frac{d\theta}{d\xi} + \frac{1}{3\tau}\xi\frac{d\theta}{d\xi} + \left(\frac{2}{3\tau} + \frac{\alpha}{2}\frac{\mu}{k_0}\frac{h^3}{\xi^3}\right)\theta +$$

$$\frac{1}{\xi}\frac{\theta^2}{2} = 0$$

Function $\theta(\xi)$ has asymptotic if $\xi \to \infty$,The decision w(x, t) determinates by formula (8) and has asymptotic if $x \to \infty$(11) [4,63].

In all submitting chances:

a) by presence source

b) by variable pervious

c) by the investigation of the process of localization disturbances are passed, which causing of LS-the regime with aggravation in gas-liquid mixture.

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