STABILITY OF THE ZERO SOLUTION IN ONE PARABOLIC BOUNDARY-VALUE PROBLEM WITH AN AUXILIARY INTERNAL CONNECTION

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Let us consider one parabolic boundary-value problem

$$\dot{u} = u'' + \gamma u - u^3, \tag{1}$$

with an auxiliary internal connection in the second edge condition

$$u'(0,t) = 0, \qquad u'(1,t) = \alpha\, u(x_0,t), \tag{2}$$

where function $u(x,t)$ is smooth for $t \geq 0$, $x \in [0,1]$, parameters $\alpha, \gamma \in \mathbb{R}$ and $x_0 \in [0,1)$. For the zero solution of boundary-value problem (1), (2) there are two ways of stability loss: divergent, when a zero appears in the stability spectrum of zero balance state, and oscillating, when a pair of complex conjugate eigenvalues have moved from the left complex half plane to the imaginary axis. Our task was to find critical values of parameters α, γ and x_0 and develop asympotic formulae for regimes derived from the zero balance state.

Since it is rather difficult to obtain required critical values of the parameters by means of analytical methods, the numerical research was carried out. As a result of numerical research, there were given critical values of parameters α, γ and x_0, when different bifurcations of the zero balance state of boundary-value problem (1), (2) occur. For various values of parameter α close to critical, the normal form was constructed and using it there were received the conditions for the appearance of spatially inhomogeneous balance states and cycles.

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