N. F. PATSEGON, S. I. POTSELUEV

STABILITY OF FREE SURFACE OF VISCOUS FERROFLUID LAYER EXPOSED TO VARIABLE MAGNETIC FIELD AND MECHANICAL VIBRATIONS

The stability of a layer of a viscous nonlinearly magnetizing ferrofluid in the non-stationary uniform magnetic field oriented arbitrary to a free surface is considered with provision for the mechanical vibrations of the layer. In case of the magnetic field composing of a constant portion and a harmonically time-varied portion, providing the rationality of relations between electromagnetic frequencies and those of the vibratory effects, the problem reduces to the study of an infinite system of the linear equations for the Fourier series of the amplitude of disturbances of a free surface of the ferrofluid. The matrix of this system is a square bunch of the known matrices whose parameter is the amplitude of the parametric effects. The problem is reduced to a linear spectral problem in which the amplitude of the parametric effects is the eigenvalue. Neutral curves of the stability are found. It is established that variations in angle of orientation of the magnetic field and an increase in its stationary component may result in the bicritical points and the transfer from the harmonic oscillation to the subharmonic oscillation. The effects of the stationary inclined magnetic field on a critical amplitude of the mechanical vibrations are non-monotonic and depend on not only the orientation of the magnetic field but on the thickness of the fluid layer. A decrease in the thickness of the ferrofluid layer can result in an increase in the threshold of the initiation of a parametric instability and excitation of waves of a lower length at its surface when losing the stability. Distinctions of the vibratory and electromagnetic mechanisms in evolution of the parametric instability of a free surface resulted from two-frequency modulation of the magnetic field are studied.

Keywords: *parametric resonance, oscillating magnetic field, mechanical vibrations, magnetic fluid.*

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