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Section:

9. Ordinary Differential Equations and Dynamical Systems

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Investigation of m-frequency oscillatory systems

The perturbed system of equations in $\mathbb{R}^{2n}$ of the form

$$\frac{dx}{dt} = \lambda H x + \varepsilon X(x)$$

is considered, where $\lambda H = \operatorname{diag}\{\lambda_1 H_1, \ldots, \lambda_n H_n\}$, $\lambda = (\lambda_1, \ldots, \lambda_n)$ are the frequencies of the unperturbed system with the frequency basis $\omega = (\omega_1, \ldots, \omega_m)$, $H_\nu^2 = -E$, $\nu = \overline{1, n}$, and $X \in \mathbb{K}[x]$ is the ring of polynomials, $0 < \varepsilon \ll 1$.

For the system under consideration the algorithm of an asymptotic method [1] is presented, the analysis of the averaged equations is carried out, and the conditions of existence of p-dimensional invariant tori with arbitrary $1 \leq p \leq m$ are obtained.

Reference: [1] Yu. A. Mitropolsky and A. M. Samoilenko, To the problem of asymptotic expansions in nonlinear mechanics // Ukr. Mat. Zh. **31** (1979), pp. 42–53.