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The dynamic behavior of [thermodynamic systems](#) described by a single order parameter and several control parameters is studied in a small neighborhood of ordinary and bifurcation equilibrium values of the system parameters. Using the general methods of investigating the branching (bifurcations) of solutions for [nonlinear equations](#), we performed an exhaustive analysis of the order parameter dependences on the control parameters in a small vicinity of the equilibrium values of parameters, including the stability analysis of the [equilibrium states](#), and the [asymptotic behavior](#) of the order parameter dependences on the control parameters (bifurcation diagrams). Relations between the infinitesimal quantities of order parameters and the control of [dynamical systems](#) are given, and the formulae for the order parameter sensitivity are presented depending on the variations in the control parameters. In addition, we carried out specific calculations with respect to the thermodynamic systems described by one order parameter and several control parameters in the Landau-type [kinetic potential](#). The peculiarities of the anomalous generation and extinction phenomenon of crystal nuclei at very low temperatures in non-equilibrium supercooled liquids are also presented.