

Andrej Il'ichev

Weakly-nonlinear regimes near the threshold of instability in geothermal systems

We consider a high-temperature geothermal reservoir, consisting of two layers, separated by phase transition interface. The upper and lower layers are occupied by water and vapor, respectively. Geothermal reservoir gives an example of the natural system where the thermodynamic states are realized, supporting the stable existence of water (the heavier fluid) over vapor (the lighter fluid). The two types of the onset of instability of the vertical flows in such systems are accompanied by bifurcations of the destabilizing vertical flows corresponding to the simple resonance and 1:1 resonance (which typically arise in reversible systems). The weakly-nonlinear stage of the instability in these cases are described by the Kolmogorov-Petrovsky-Piscounov equation and the Ginzburg-Landau-like equation, correspondingly. The possible regimes and scenarios of nonlinear development of instability as governed by these equations are analyzed.