Stability Analysis of Magnetic Flux in the LJJ Model with Double Sine-Gordon Equation

P. Kh. Atanasova, T. L. Boyadjiev,
E. V. Zemlyanaya, Yu. M. Shukrinov

he decrease of the barrier transparency in superconductor-insulator-superconductor Josephson junctions leads to the deviations of the current-phase relation from the sinusoidal form. The sign of second harmonics is important for many applications, in particular in junctions with a more complex structure like SFINS or SFIFS, where N is a normal metal and F is a weak metallic ferromagnet. In our work we study the static magnetic flux distributions in long Josephson junctions taking into account the higher harmonics in the Fourier-decomposition of the Josephson current. Stability analysis is based on numerical solution of a spectral Sturm-Liouville problem formulated for each distribution. In this approach the nullification of the minimal eigenvalue of this problem indicates a bifurcation point in one of parameters. At each step of numerical continuation in parameters of the model, the corresponding nonlinear boundary problem is solved on the basis of the continuous analog of Newton's method. The solutions which do not exist in the traditional model have been found. The influence of second harmonic on stability of magnetic flux distributions for main solutions is investigated.