Contribution ID: **244** Type: **Poster Presentation**

Chaotic Phenomena in Stack of Josephson Junctions

Wednesday, 9 July 2014 17:10 (1h 50m)

Abstract content
   (Max 300 words)
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Nowadays Josephson junctions (JJ) have important applications in quantum-mechanical circuits such as SQUIDs, superconducting qubits, and RSFQ digital electronics. The phase dynamics is one of the key moments in the studies of JJ. Chaos in the stack of JJ often has negative influence on work of devises based on Josephson effect, so it is important to avoid it. Consequently, it is necessary to know parameters upon which chaos in JJ occurs and how chaotic states are developed.

In present research the phase dynamics of JJ with different values of dissipation parameter in the interval (0.1,0.6) for different values of the amplitude and frequency of the external electromagnetic radiation is investigated. We use the resistively and capacitively shunted junction model. To simulate IV-characteristics and the Poincare sections we solve the system of nonlinear differential equations using 4-th order Runge-Kutta method.

We present results demonstrated the fragmentation of the Shapiro steps and their subharmonics. The influence of the coupling between JJ in the stack on the subharmonic structure is studied. Behavior between first and second harmonics is investigated. We study effect of coupling between junctions on current voltage characteristics at β=0.3, Ω=0.5 and A=0.8. We found nontrivial disappearance of Shapiro step subharmonics with increase in the coupling parameter. The influence of radiation and parameters of Josephson junctions in the stack on chaotic phenomena is discussed. These results may be used in design devices based on JJ.

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Session Classification: Poster2

Track Classification: Track G - Theoretical and Computational Physics