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IVC Calculation Problem for Josephson Junction Stacks. On Asymptotic Construction near the Breakpoint .

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A detailed investigation of the IVC breakpoint and the breakpoint region width gives important information [1],[2] concerning the peculiarities of stacks with a finite number of intrinsic Josephson junctions. In [3] IVC for a stack of n Josephson junctions is defined numerically using the fourth- order Runge-Kutta method. The current voltage characteristic has the shape of a Hysteresis loop. On the back branch of the Hysteresis loop, near the breakpoint I_b , voltage $V(I)$ decreases to zero rapidly. In addition, in numerical modelling (non-periodic boundary condition) IVC branching is observed near I_b . It is interesting to study this phenomenon analytically developing asymptotic methods. A numerical-analytical method was proposed in [4]. The general scheme of suggested numerical-analytical method of the hysteresis loop calculation is following: the right branch of the hysteresis loop and the back branch (not nearing some finite distance to I_b)

are calculated using the “asymptotic” formulas. The rest points (I ; $V(I)$) of the hysteresis loop are calculated numerically using the fourth- order Runge-Kutta method. This method showed good results in IVC branching calculation in particular. I succeeded to calculate analytically the whole hysteresis loop in the case of periodic boundary conditions. The approximate solution at the breakpoint region had been developed using the Bogolyubov-Krylov method [5].

1. Zappe H.H. Minimum current and related topics in Josephson tunnel junction devices// Journal of Applied Physics, Vol.44, No.3, 1371-1377, 1973.
2. Matsuda Y., Gaifullin M.B., Kumagai K., Kadowaki K. and Mochiku T. Collective Josephson Plasma Resonance in the Vortex State of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+d}$ //Vol.75, No.24,4512-4515,1995.
3. Shukrinov Yu.M., Mahfousi F. and Pedersen N.F. Investigation of the Breakpoint Region in Stacks with a Finite Number of Intrinsic Josephson Junctions //Phys.Rev. B 75,104508, 2007.
4. Serdyukova S.I. Numerical-Analytical Method for Computing the Current-Voltage Characteristics for a Stack of Josephson Junctions//Computational Mathematics and Mathematical Physics,2012, Vol.52, No.11, pp. 1590-1596.
5. Н.Н.Боголюбов и Ю.А.Митропольский “Асимптотические методы в теории нелинейных колебаний”, ФМ, Москва 1963, стр.48.

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