Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

6.763 Applied Superconductivity

Problem Set 7

Handed Out: Thursday, October 30, 2003 (in class)
Due: Thursday, November 6, 2003

Problem 1: Problem 9.1.

Problem 2: Problem 9.5.

Problem 3:

Copy the files `jj.m`, `jjivh.m`, and `jjplot.m` from the email to your MATLAB directory on Athena.

(a) Use `jjivh.m` to plot the IV's for a number of different Stewart-McCumber Parameters, say ($\beta_c = 0.1, 0.5, 1, 5, 10, 15$). Use these to graph (1) The current where the junctions switches from the zero-voltage state to the finite voltage state as the current is increased from zero current and (2) the current where the juncitons switches from the finite-voltage state to the zero-voltage state when the current is decreased from a high value. (You may note some numerical errors if you make $\beta_c \gg 10$, which can be resolved by increasing the integration time, but don't worry about doing this.)

(b) Use `jjplot.m` to plot the time dependence and voltage dependence for a few selected points for $\beta_c = 0.1$ and $\beta_c = 10$. The program asks for an initial point $[\phi, \dot{\phi}]$.

(c) An often used approximation is that $\phi(t) = \omega_o t + A \sin(\omega_1 t + \delta)$, where ω_o, ω_1, and δ depend on the average dc voltage. Use your results from part (b) to estimate what ω_0 and ω_1 are in terms of the average dc voltage. Note that time is in units of $\sqrt{\tau_J \tau_{RC}}$ and the voltage is in units of $I_C R$.

Outline of report, including references is due on Thursday November 13, 2003.