## The bifurcation phenomena in the resistive state of the narrow superconducting channels

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The current-voltage characteristics (CVCs) of the narrow superconducting channels are investigated by direct numerical integration of the time-dependent Ginzburg-Landau equations (TDGLEs)[1] for different lengths of the wire. We have demonstrated that singularities of the CVC correspond to a number of different bifurcation points of the TDGLEs. We have discovered some universal features of the CVC. The voltage appearance in the system corresponds to the saddle-node homoclinic bifurcation leading to the formation of the limit cycle with a diverging period when $j \to j_c$. It also leads to the formation of the phase slip center (PSC) in the middle of the wire in agreement with experimental results[2]. The voltage $V \propto (j - j_c)^{1/2}$ in this region. We have also analytically estimated the period of oscillations in the vicinity of this bifurcation. The second singularity corresponds to the period-doubling bifurcation. In that case two adjacent PSCs are shifted in opposite directions with respect to the center of the wire in striking similarity with the experimental results[2]. As a result of this bifurcation, a new frequency $\omega_2 = \omega_1/2$ appears in the spectrum. The next bifurcation is the destruction of the limit cycle. It doesn't generate any clear singularity on the CVC. Further increase of the current leads to a nonuniversal CVC's behavior.

[1] L.P. Gor'kov, N.B. Kopnin, Sov. Phys. Usp. **18**, 496 (1975)
[2] A. G. Sivakov et al., Phys. Rew. Lett. **91**, 267001 (2003)