Supplemental Material to the article "Periodicity of magnetization reversal intervals in φ_0 junction"

Here we present the results of simulations [1] of magnetization reversal dynamics based on the equation

$$I = w\left(\frac{d\varphi}{dt} - r\frac{dm_y}{dt}\right) + \sin(\varphi - rm_y), \tag{1}$$

without the $r\frac{dm_y}{dt}$ term, which is considered small as in [2, 3]. Based on comparison of Fig. S1 and Fig. S4 with corresponding figures of main text of our papers, we see, that this term does not lead to the qualitative changes, however it is necessary for the gauge invariance of used equations [4].

The time dependence of magnetization component m_z for different values of spin–orbit coupling parameter r, Gilbert damping parameter α and Josephson energy relation to the magnetic one G for the first and second bands are presented in Fig. S2, S3, S5, S6.

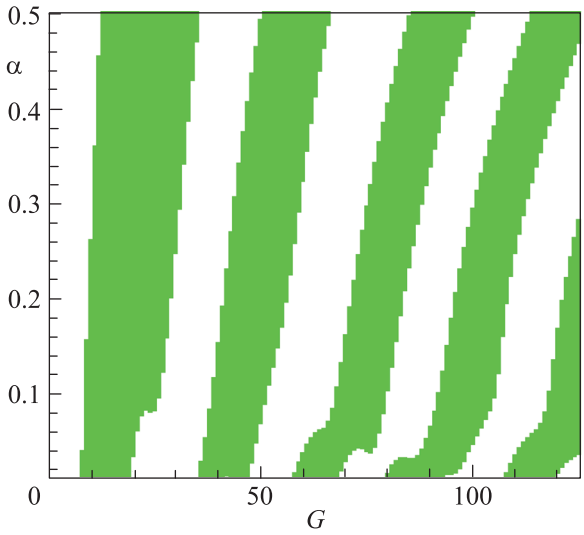

Fig. S1. Demonstration of periodicity of magnetization reversal intervals in (G, α) plane based on the equation (1) without the $r\frac{dm_y}{dt}$ term. Results are obtained with the step $\Delta G = 1$ and $\Delta\alpha = 0.001$ at $A_s = 1.5$, $r = 0.1$, $t_0 = 25$, $\Delta t = 6$, $\omega_F = 1$

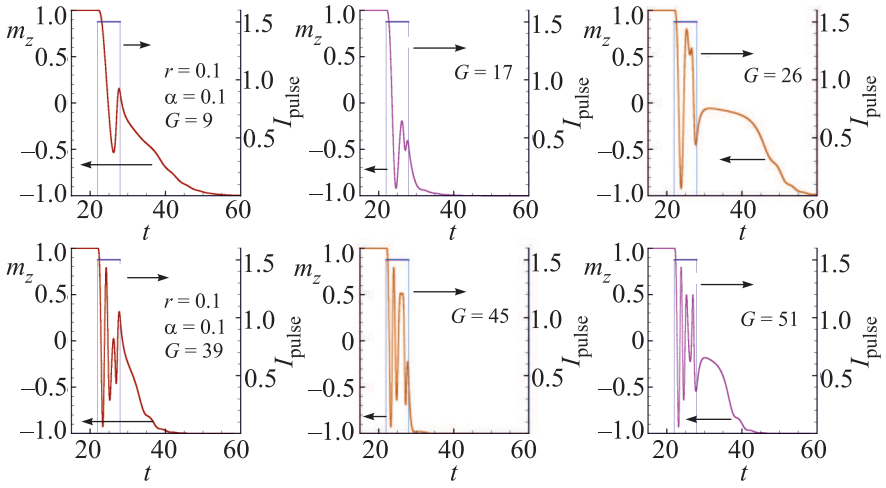

Fig. S2. Time dependence of magnetization component m_z for the different values of G (indicated in the figure) at $\alpha = 0.1$ for the first and the second bands

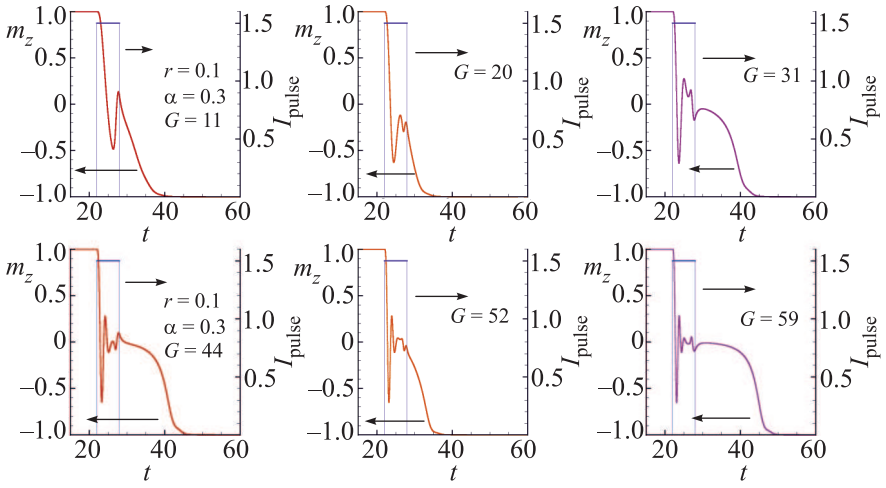

Fig. S3. Time dependence of magnetization component m_z for the different values of G (indicated in the figure) at $\alpha = 0.3$ for the first and the second bands

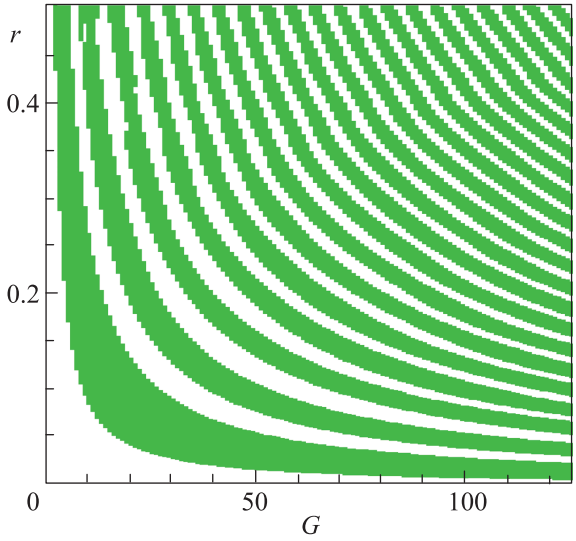

Fig. S4. Demonstration of periodicity of magnetization reversal intervals in (G, r) plane based on the equation (1) without the $r\frac{dm_y}{dt}$ term. Results are obtained with the step $\Delta G = 1$ and $\Delta r = 0.01$ at $A_s = 1.5$, $\alpha = 0.1$, $t_0 = 25$, $\Delta t = 6$, $\omega_F = 1$

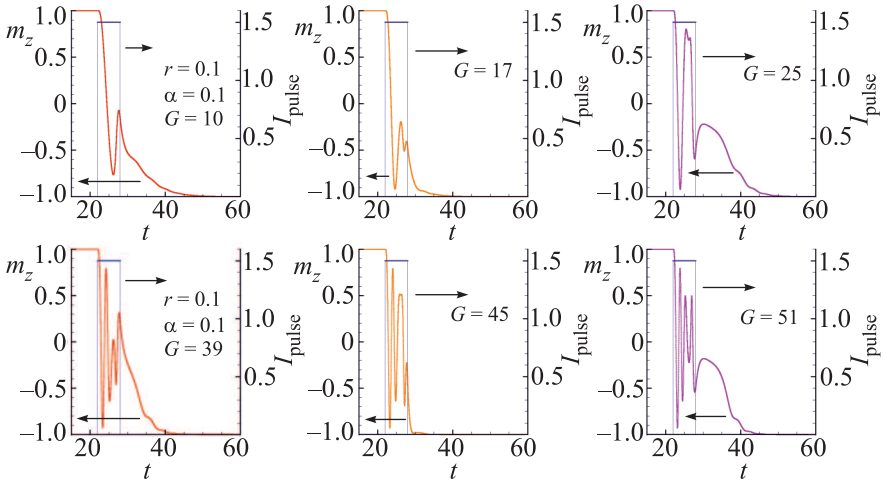

Fig. S5. Time dependence of magnetization component m_z for the different values of G (indicated in the figure) at $r = 0.1$ for the first and the second bands

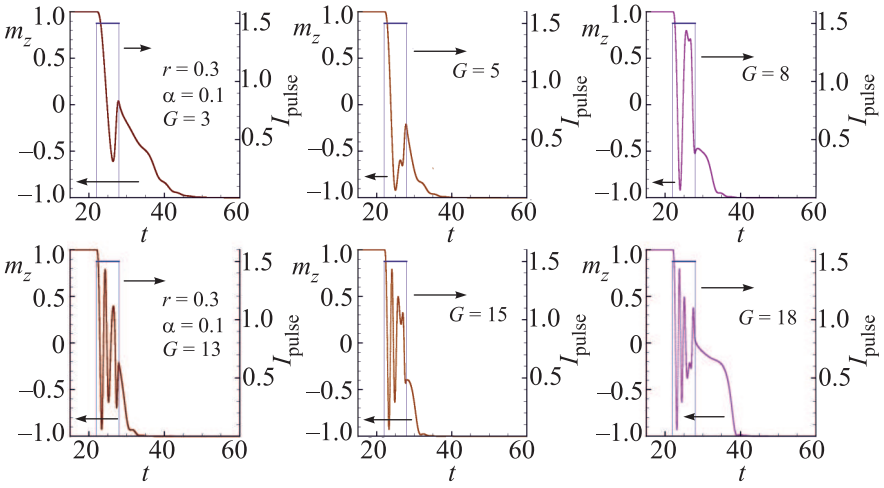

Fig. S6. Time dependence of magnetization component m_z for the different values of G (indicated in the figure) at $r = 0.3$ for the first and the second bands

References

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[3] Yu. M. Shukrinov, I. R. Rahmonov, K. Sengupta, and A. Buzdin, Appl. Phys. Lett. **110**, 182407 (2017).

[4] D. S. Rabinovich, I. V. Bobkova, A. M. Bobkov, and M. A. Silaev, Cond-Mat ArXiv 1904.03449 (2019).