

Abstract Submitted  
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**Spin circuit representation  
of spin-torque ferromagnetic resonance**<sup>1</sup> KUNTAL ROY, School of Electrical and Computer Engineering, Purdue University — Earlier we developed equivalent circuit (spin and charge circuits) representation for spin pumping from metallic ferromagnets (e.g., Py) into an adjacent material (e.g., Pt, topological insulators) possessing spin orbit coupling, detected as inverse spin Hall voltage [1]. Here, we extend such development for magnetic insulators such as yttrium-iron-garnet (YIG), for which the imaginary part of spin mixing conductance is considerable and spin Hall magnetoresistance (SMR), i.e., the dependence of electrical resistance of Pt on the magnetization direction of YIG, has been observed. In spin-torque ferromagnetic resonance (ST-FMR) experiments, an in-plane alternating current in Pt drives the magnetization precession in the magnet via direct spin Hall effect and it pumps spins into the Pt layer detected as a charge voltage via inverse spin Hall effect. We construct the corresponding spin circuit representation and analyze the available experimental results. Such equivalent circuit models developed here can be utilized to analyze and evaluate more complex devices. [1] K. Roy, in APS March Meeting, Y28.12 (2015), K18.4 (2016); in EMN Meeting on Magnetic Materials (invited), and on Spintronics (invited), (2016).

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