The paper introduces an approach to investigate voltage sags, which are caused by large generator rotor swings following a transient disturbance. Therefore, the method exploits sensitivities derived from the algebraic network equations. These provide information on the impact of a generator on the voltage magnitude at a load bus and the effect of load variation on the generator's power injection. It is shown that these sensitivities give valuable information to identify critical generator-load pairs and locations for applying preventive control measures.