Problem 3

Stewart-Tolman Effect

In 1917, Stewart and Tolman discovered a flow of current through a coil wound around a cylinder rotated axially with certain angular acceleration.

Consider a great number of rings, with the radius τ each, made of a thin metallic wire with resistance R. The rings have been put in a uniform way on very long glass cylinder, which is vacuum inside. Their positions on the cylinder are fixed by gluing the rings to the cylinder. The number of rings per unit of length along the symmetry axis is n. The planes containing the rings are perpendicular to the symmetry axis of the cylinder.

At some moment the cylinder starts a rotational movement around its symmetry axis with an acceleration α. Find the value of the magnetic field B at the center of the cylinder (after a sufficiently long time). We assume that the electric charge e of an electron, and the electron mass m are known.