INDUCED MAGNETIC FIELDS FROM LARGE, NEAR-SPHERICAL CONDUCTORS, WITH APPLICATION TO EUROPA. M. J. Styczinski[1] and E. Harnett[1], [1]University of Washington (mjstyczi@uw.edu).

Conducting bodies exposed to time-varying magnetic fields induce secondary magnetic fields from movement of eddy currents. In the case of spherically symmetric conducting bodies, matching magnetic solutions at the boundary results in relatively simple relations between the excitation field and the induced field. In this work, we determine the more complicated induced magnetic field from a near-spherical conductor, where the outer boundary is expanded in spherical harmonics of up to degree 2. Under the approximations that the excitation field is uniform at a single frequency, the product of conductivity and radius for the body is large, and the average radius of the body is large compared to the perturbation from spherical symmetry, we find that each spherical harmonic in the shape expansion induces discrete magnetic moments that are independent from the other harmonics in the expansion. That is, simple superposition applies to the magnetic moments induced by each perturbation harmonic. We present a table of the magnetic moments induced by each spherical harmonic in the perturbed shape. We also present a simple formula by which the induced magnetic field may be evaluated for any arbitrary shape described by expanding the radius of the conducting body in spherical harmonics up to degree 2.

Many moons in the Solar System are tidally locked and contain subsurface oceans; asymmetries in gravitational field, thermodynamics, and composition will result in deviation from spherical symmetry by the outer boundary of these oceans. Dissolved salts expected to be present in the oceans of these moons are effective electrical conductors. The large size, nearly spherical shape, and moderate to high conductivity of their oceans make several moons promising candidates for study using the method we describe. Deviation from spherical symmetry of subsurface oceans has never been included in past studies. For Europa in particular, a careful analysis of *Galileo* magnetometer data allows us to constrain the amount of asymmetry that may be present in its ice−ocean boundary. Induced magnetic fields are determined using our method, for maxima of each perturbation harmonic; induced fields are then compared to *Galileo* data to determine the maximum asymmetry that may be consistent with magnetic field measurements. Similar applications may be made to Ganymede and Callisto, and Enceladus, which may be subjected to oscillatory magnetic fields owing to libration. The method we describe permits magnetic studies of the effects of symmetry breaking in these bodies for the first time.

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