Volume Currents in Forward and Inverse MEG Simulations using Realistic Head Models

Robert Van Uitert, David Weinstein, and Chris Johnson

UUCS-01-011

School of Computing
University of Utah
Salt Lake City, UT 84112 USA

September 12, 2001

Abstract

Many magnetoencephalography (MEG) forward and inverse simulation models employ spheres, a singular shape which does not require consideration of volume currents. With more realistic, inhomogeneous, anisotropic, non-spherical head models, volume currents cannot be ignored. We verify the accuracy of the finite element method in MEG simulations by comparing its results for a sphere containing dipoles to those obtained from the analytic solution. We then use the finite element method to show that in a realistic model, the magnetic field normal to the MEG detector due to volume currents often has a magnitude on the same order or greater than the magnitude of the primary magnetic field from the dipole. Forward and inverse MEG simulations using the realistic model demonstrate the disparity in results between calculations containing volume currents and those without volume currents. Volume currents should be included in any accurate calculation of MEG results, whether they be for a forward or inverse simulation.