Speaker : K SIBA KIRAN GURU

Title: - Particle Motion in the Earth's Magnetic Field & it's Visualization Using COMSOL Simulation

Abstract: -Earth's outer atmosphere (mainly ionosphere and magnetosphere) is composed of various charged particles having range of energies (eV to MeV) and by virtue of their properties they interact with earth's magnetic field and produces different motions. The particle motion is governed by three basic adiabatic invariants. These energetic particles when trapped in the Earth's magnetic field can undergo bounce, gyration and drift motion that can impact our satellites, atmosphere-ionosphere-thermosphere system and radio communication blackouts. Hence, they impact our daily lives in so many ways. Due to their high energies, they may potentially damage space equipment such as GPS and communication satellites, can cause disruption in power supply also radiation from these particles can pose various health hazards to aircraft personnel and passengers. Thus, understanding the source and subsequent transportation of such particles is of practical and scientific importance.

As we know that earth's magnetic field is not uniform everywhere (though we take dipole approximation there are some anomalies present) it varies both latitudinally and altitudinally. Hence, the particle motion and dynamics will be different in each respective location. Mathematically this can be shown by solving basic electromagnetic field equations analytically or numerically. The standard mathematical description of the large-scale structure of the Earth's main magnetic field and its secular variation is represented by IGRF model which uses spherical harmonics.

There are various ways to visualize particle motion. One of the methods is simulation (by means of coding or by using simulation software based on physics). In this talk I will try to explain some basics equations of particle motion in magnetic field, basic interface of COMSOL Multiphysics software and how to simulate particle motion using this software to visualize the actual scenario. This basic knowledge of this software can be extended to various other types of simulations also.