INTERACTIVE VISUALIZATION OF VECTOR FIELDS INSIDE CYLINDRICAL WAVEGUIDES
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Electromagnetic is considered to be a very difficult subject by many students and engineers because of the abstract electromagnetic concepts that must be visualized in time and multi-dimensional space. Field phenomena are normally expressed in three-dimensional vector notation and are physically invisible. The novice experiences considerable difficulty in relating the associated mathematical models to good mental images. Consequently, the degree of individual motivation to learn and research the subject matter is one of the lowest of the areas of electrical engineering, in spite of the fundamental importance of this topic. Fortunately, the advent of personal computers and computer graphics has provided a unique opportunity to develop materials toward the goal of rectifying this situation and overcoming many of these conceptual difficulties. An educational software package is therefore developed to enable students and researchers to visualize interactively the propagation of electromagnetic waves inside cylindrical waveguides. This work is based on the development of field formulation which can be used to generate fast execution algorithms for program development. The research resulted in a computer program that illustrates, in a simple graphical way, the behavior of the electromagnetic field components for various electrical and physical parameters such as frequency, waveguide physical dimensions, and modes of operation. These formulations and algorithms are developed for a personal computer to be used conveniently for research and instruction applications. This software package is a major upgrade on the recently developed software WGVMAP (version 1) which was developed based on the support from the Computer Application in Electromagnetic Education Center (CAEME).

STOCHASTIC MODELING OF ASH PARTICLE AGGLOMERATION Z.P. Zhang and W.Y. Chen, Department of Chemical Engineering, Anderson Hall

The dynamics of fly ash coagulation, i.e., the variation of the particle-size distribution with time, has been modeled by the master-equation approach. The particles have been lumped into a limited number of states, each representing one size (volume) range of particles. The number of particles in an individual state in the system is represented by a random variable. In order to cover a broad range of particle sizes, the characteristic volumes of particle size range are represented by a geometry series. The master equation governing the distribution has been derived by stochastic population balance of particle numbers in each state with the transition intensity functions governed by collision frequency and the sticking probability between individual particles. The systematic expansion of this master equation yields not only the macroscopic equation which corresponds to the average behavior of the system but also the fluctuation equation. By fitting the model to the experimental data, the parameters in the transition intensity function have been recovered. The regression has been achieved by resorting to BCONF/DBCONF, a subroutine in IMSL which minimizes a multi-variable function. The integration of the large sets of differential equations has been carried out on a Cray X-MP2/216 supercomputer with LSODE, a software package based on Gear's method for solving stiff differential equations. A good agreement with the experimental data demonstrates that the present model is capable of depicting the and means and fluctuations of particle numbers in various size ranges at any time.