ELECTROMAGNETIC WAVE-PARTICLE INTERACTION USING CAVITY MODAL EXPANSION

By

Ahmed Farghaly Abdelrahman Abdelshafy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfilment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electronics and Communications Engineering

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Under the Supervision of

Associate Prof. Tamer Mostafa Abuelfadl

Advisor

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Key Words:
Wave-Particle Interaction; Cavity Modal Expansion(CME); Particle in Mode(PIM); Cherenkov radiation

Summary:
A new technique to simulate the interaction between the electromagnetic fields and charged particles. This technique is based on Cavity Modal Expansion whereby the known solenoidal and irrotational eigenmodes of a canonical cavity are employed to solve different electromagnetic problems. In this study, the technique is employed to solve a cold electromagnetic problem like circular waveguide excited by an axial current probe to obtain the transient solution in order to validate time domain model. Also, it is employed to solve a hot electromagnetic problem, where the interaction between the fields and particles occurs, as Cherenkov radiation to obtain the dynamic behavior of the particle as well as the electromagnetic fields radiation.

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Ahmed.

Dedication

This thesis dedicated to my family and friends.

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