Centre d'Etudes Doctorales
« Sciences et Technologies » Tétouan

AVIS DE SOUTENANCE DE THESE

En vue de l'obtention du DOCTORAT EN SCIENCES

Le Doyen de la Faculté des Sciences de Tétouan annonce que

Monsieur Mohammed Kanjaa soutiendra une thèse intitulée

EFFICIENT DISCRETE MODELLING OF BIOLOGICAL TISSUES BY THE TLM METHOD

Discipline : Physique

Spécialité : Electronique & Télécommunications

Salle des soutenances, Faculté des Sciences de Tétouan

Le Samedi 25 juillet 2020 à 10h

Devant le jury composé de:

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Résumé

Numerical models of biological tissues are receiving significant interest lately, because they can represent the response of these tissues toward electromagnetic (EM) fields in simulated scenarios before any real system conception. This feature is paramount for fields like (EM) dosimetry and microwave imaging. The modeling of biological tissues are particularly challenging because of their in-homogeneity and dispersive proprieties. The anomalous relaxation of the polarization when exposed to the (EM) field resulted in models involving fractional differential equations like Cole-Cole or Havriliak-Negami media.

In this work Several Transmission Line Matrix (TLM) algorithms using the Auxiliary Differential Equation (ADE) method were analyzed and tested in order to solve Maxwell's equations in non-trivial (non-linear dispersive) materials modeling the biological tissues. Particular attention is devoted to the boundary conditions by implementing an unsplitted boundary conditions for the numerical simulation domain.

The aim of this work is twofold: First efficiency of the proposed models was tested by numerical simulations of the reflection on the PML layers before using them to truncate the numerical domain. Then, the simulated interaction of the (EM) field with multipoles Debye and Cole-Cole media was tested and successfully compared to analytical values.

keywords : TLM method, EM Propagation, Auxiliary differential equations (ADE), Debye model, Cole-Cole model, Perfectly Matched Layers (PML), Biological tissues.