User's manual for tissue model code
Optical Science Lab
Revision 1.0

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1 Introduction

This will provide an introduction to the tissue model generation function, *skin_create* . It is important to note that the function's name is a little misleading because this function is flexible enough that it can be utilized to create many types of biological tissue. It is important to note that this manual assumes a basic knowledge of MATLAB programming.

2 Getting Started

The code *skin_create* creates and discritizes a tissue model with set optical properties. The spatial location and number of cellular components are randomized each time.

3 Calling the program

Call the FDTD program as follows:
[media] = skin_create(media,Ewave,options);

The inputs *media*, and *options* are structures that are described in Sections 3.1, and 3.2, respectively. A brief description of each input is provided in Table 1. The structure *Ewave* only requires a single field.
Ewave.lambda0 – wavelength of the electromagnetic wave to be simulated.

Variable	Description
media	Structure that stores information about medium. (See Section 3.1)
Ewave.lambda0	Wavelength of field that will propagate through medium
options	structure specifies options for the user (See Section 3.2)

Table 1: The inputs for the function *execute_FDTD*.

3.1 media

This structure contains all the basic information that describes the model space size

- .depth – The depth of the medium
- .width – The width of the medium
- .randstate (optional) – This provides *skin_create* with a randomstate to begin with. This is provided so a user can regenerate a particular medium.

Note: all these fields are called as follows:
media.XXXX
where XXXX is the field described above.

3.2 options

This structure is a 'catch all' that allows the user maximum versatility with the *skin_create* function without having to edit the actual code. The options structure can change the number of subcellular components, number of layers, starting place for each layer and so on. Because *options* allows the user to completely specify the tissue geometry, it has many substructures that will be explained below.

3.2.1 options.cell

This substructure contains all the information about the cellular components. These are listed in Table 3.2.1.

Variable	Purpose	Default
.posd	Initial depth for the cell layers within the tissue.	0
.drad0	Maximum radius in the depth dimension.	5 μm
.xrad0	Minimum radius in the x–direction	20 μm
.rad	Final radius of the cell	10 μm

Variable	Purpose
.nn	
.nm	
.nml	
.ncy	
.ndermis	
.nbck	

3.2.2 options.indicies

3.2.3 options.mito

3.2.4 options.mel

3.2.5 options.DE

4 Outputs

After execution, *execute_FDTD* will automatically store the structures in *media* and *Ewave*.

4.1 Ewave

In addition to the input fields, the structure *Ewave* will also contain the following:

- .Ez_field – real electric field (z–direction) for the final time-step of the

Variable	Purpose
.mradm	
.mradt	

Variable	Purpose
.mlrad	
.nummelanin	

Variable	Purpose
.depth	
.period	
.DEamp	

simulation

- .Hx_field – real magnetic field (x–direction) for the final time-step of the simulation
- .Hy_field – real magnetic field (y–direction) for the final time-step of the simulation

If you also specified the necessary information for a detector, you will also find the signal at the detector–depth versus time in
Ewave.detector.timesig