

MODELOWANIE I SYMULACJA ZAGADNIEŃ BIOMEDYCZNYCH

Tomasz STREK

Institute of Applied Mechanics, Poznań University of Technology
ul. Jana Pawła II 24, 60-965 Poznań, Poland

DATE: 2018-04-10

VERS: 2018-04-10

BIOHEAT TRANSFER

EQUATIONS

The screenshot shows a CAD software interface with a tree view of study components on the left, a domain selection dialog in the center, and a 3D model in the viewer on the right.

Left Panel (Tree View):

- Definitions
- Geometry 1
- Materials
 - Skin (mat1)
 - Muscle (mat2)
 - Fat (mat3)
 - Bone (mat5)
 - Blood (mat6)
 - Water, liquid (mat8)
- Bioheat Transfer (ht)
 - Biological Tissue 1
 - Bioheat 1
 - Initial Values 1
 - Thermal Insulation 1
 - Heat Transfer in Solids 1
 - Heat Transfer in Fluids 1
 - Temperature 1
 - Temperature 2
 - Heat Flux 1
- Mesh 1
- Study 1
- Results
 - Data Sets
 - Derived Values

Center Panel (Domain Selection Dialog):

Label: Bioheat 1
Domain Selection
Selection: All domains

<input checked="" type="checkbox"/> 1
2
3
Active 4 (not applicable)
5 (not applicable)

Right Panel (3D View):

A 3D model of a cylinder representing a biological tissue. The cylinder has a central hole and is divided into two regions: a lighter blue inner region and a darker blue outer region. The model is plotted against a coordinate system with axes x, y, and z. The axes are labeled with values: x from -0.02 to 0.02, y from -0.04 to 0.04, and z from -0.04 to 0.04. The top surface of the cylinder is also shaded in blue.

Messages Progress Log Table

▼ Equation

Show equation assuming:

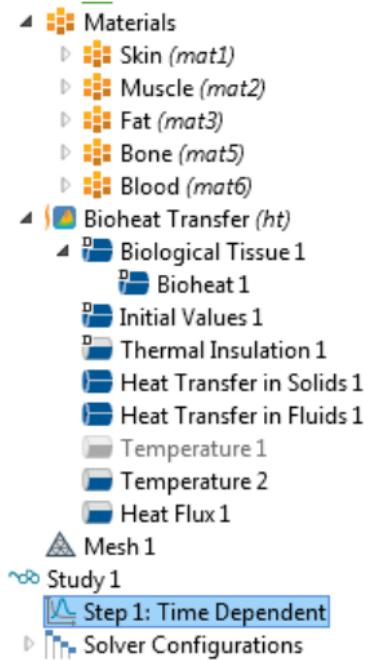
Study 1, Time Dependent

$$\rho C_p \frac{\partial T}{\partial t} + \rho C_p \mathbf{u} \cdot \nabla T + \nabla \cdot \mathbf{q} = Q + Q_{\text{bio}}$$

$$Q_{\text{bio}} = \rho_b C_b \omega_b (T_b - T) + Q_{\text{met}}$$

PARAMETERS

	Blood	Skin	Fat	Muscle	Bone	Water
Thermal conductivity, k [W/(m*K)]	0.543	0.37	0.21	0.49	0.32	0.56-0.68
Density [kg/m^3]	1060	1109	911	1090	1908	1000-750
Heat capacity at constant pressure [J/(kg*K)]	4180	3391	2348	3421	1313	4200-5200
Blood perfusion[1/s]	6.4e-3[1/s]	-	-	-	-	-
Geometry						-
Radius [mm]	3	43	40	35	15	-



Label: Time Dependent

Study Settings

Time unit: min

Times: range(0,2,60) min

Relative tolerance: 0.01

Results While Solving

Physics and Variables Selection

Modify physics tree and variables for study step

Physics interface	Solve for	Discretization
Bioheat Transfer (ht)	<input checked="" type="checkbox"/>	Physics setting

Values of Dependent Variables

Segment ciała	$h_c \left[\frac{W}{m^2 \cdot K} \right]$
Stopa	5,1
Podudzie	4,1
Udo	4,1
Miednica	3,4
Głowa	3,6
Dłoń	4,1
Przedramię	3,7
Ramię	2,9
Klatka piersiowa	3,0
Plecy	2,9
Ciało całe	3,4

RESULTS

