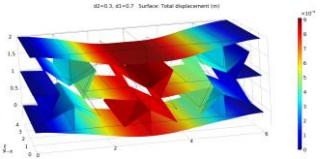

MODELOWANIE I SYMULACJA ZAGADNIEŃ BIOMEDYCZNYCH

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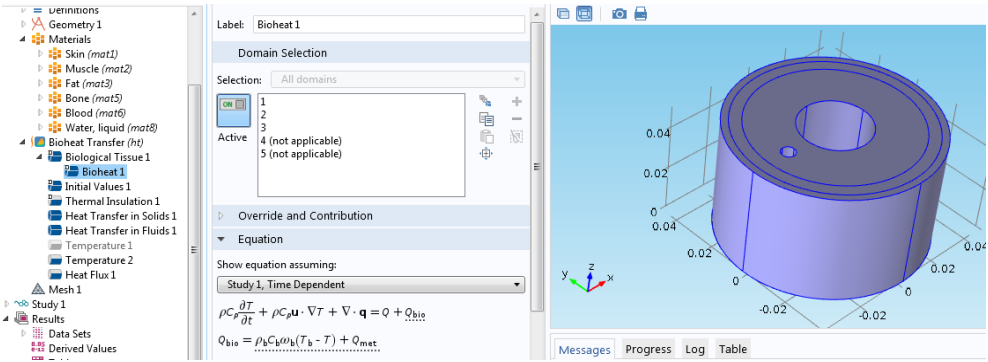
DATE: 2018-04-10
VERS: 2018-04-10

BIOHEAT TRANSFER

EQUATIONS



Equation

Show equation assuming:

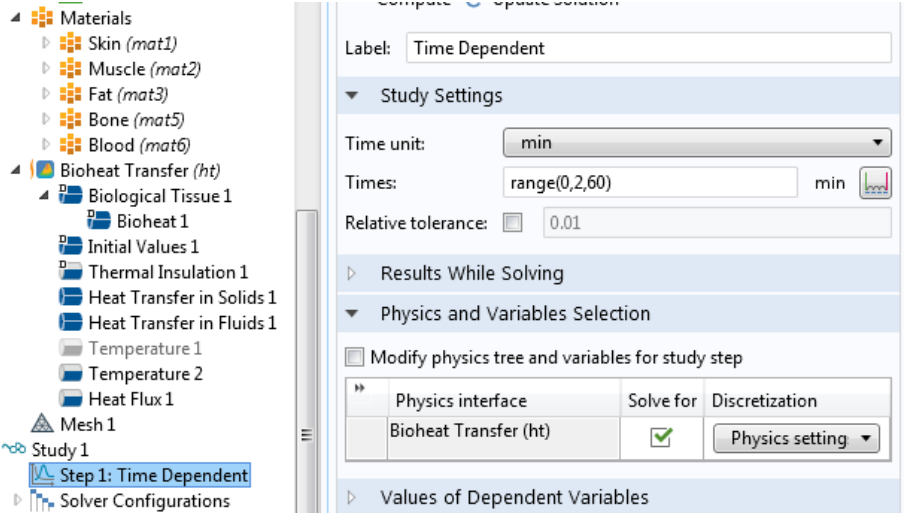
Study 1, Time Dependent

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

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

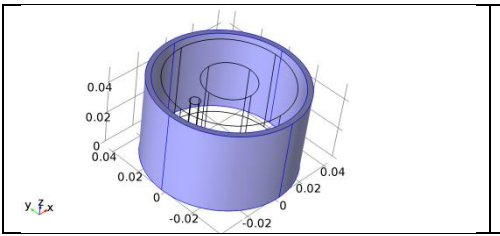
PARAMETERS

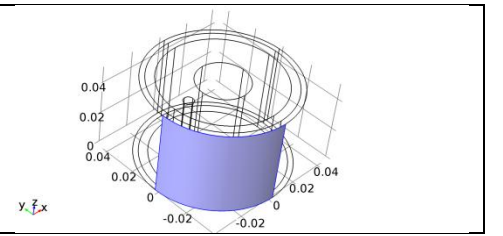
	Blood	Skin	Fat	Muscle	Bone	Water
Thermal conductivity, k [W/(m*K)]	0.543	0.37	0.21	0.49	0.32	0.56-0.68
Density [kg/m^3]	1060	1109	911	1090	1908	1000-750
Heat capacity at constant pressure [J/(kg*K)]	4180	3391	2348	3421	1313	4200-5200
Blood perfusion[1/s]	6.4e-3[1/s]	-	-	-	-	-
						-
Geometry						-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

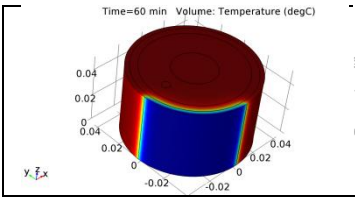

Materials
Skin (mat1)
Muscle (mat2)
Fat (mat3)
Bone (mat5)
Blood (mat6)
Bioheat Transfer (ht)
Biological Tissue 1
Bioheat 1
Initial Values 1
Thermal Insulation 1
Heat Transfer in Solids 1
Heat Transfer in Fluids 1
Temperature 1
Temperature 2
Heat Flux 1
Mesh 1
Study 1
Step 1: Time Dependent
Solver Configurations
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)
Physics setting
Values of Dependent Variables

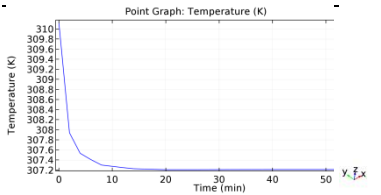
Segment ciała	$h_c \left[\frac{W}{m^2 \cdot K}\right]$
Stopa	5,1
Podudzie	4,1
Udo	4,1
Miednica	3,4
Głowa	3,6
Dłoń	4,1
Przedramię	3,7
Ramię	2,9
Klatka piersiowa	3,0
Plecy	2,9
Całe ciało	3,4

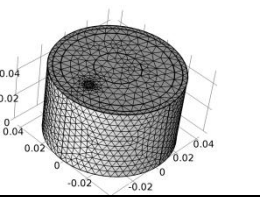
RESULTS


0.04
0.02
0
0.04
0.02
0
-0.02
-0.02
0.04
0.02
0
y z x


0.04
0.02
0
0.04
0.02
0
-0.02
-0.02
0.04
0.02
0
y z x


Time=60 min Volume: Temperature (degC)
0.04
0.02
0
0.04
0.02
0
-0.02
-0.02
0.04
0.02
0
y z x


Point Graph: Temperature (K)
Temperature (K)
310
309.8
309.6
309.4
309.2
309
308.8
308.6
308.4
308.2
308
307.8
307.6
307.4
307.2
0
10
20
30
40
50
Time (min)
y z x


0.04
0.02
0
0.04
0.02
0
-0.02
-0.02
0.04
0.02
0