Study of Biological System using Heat Transfer Equations

S. Hossain & F. A. Mohammadi
Ryerson University
Toronto, ON, Canada

Abstract—A simplified one-dimensional bioheat transfer model of the spherical living tissues in the steady state has been set up for application in heat transfer studies based on the Pennes' bioheat transfer equation and its corresponding analytical solution by using Bessel's equation has been derived in this paper. The obtained analytical solution is applied to analyze the effects of the metabolic heat generation, the tissue thermal conductivity, the blood perfusion and the coefficient of heat transfer on the temperature distribution in living tissues. A further parametric analysis has been made to reveal the tumour size, hyperactivity rate and location based on the temperature distribution profile. The results show that the derived analytic solution is useful to easily and accurately study the thermal behaviour of the biological system, and can be extended to thermal behaviour research of biological system, thermal parameter measurements, temperature field reconstruction and clinical treatment.

***Index Terms*: Bioheat transfer, Pennes' equation, analytical solution, Bessel functions, tumour**

IJARE