

Numerical Modeling of Bio-Heat Transfer

Heat transfer in vascularized tissues is a problem of interest in medical procedures where heating or heat removal may play a role, such as tumor ablation, thermo-imaging. The common model that is used to describe the energy balance is the bioheat equation (Pennes), which relies on the assumption of a continuous heat source/sink distribution that accounts for the blood perfusion rate as enthalpy carrier to model the contribution of the blood vessels to the heat transfer. However, as recognized, this approach may be of limited accuracy and misleading when larger than the capillaries vessels are present in the region of interest too. Following this path, we present a synthesis of several studies concerned with evaluating the heat transfer in thermography and ablation needed for more accurate localization of biological heat sources and in planning interstitial, localized ablation, where the heat is conveyed through hemodynamic flow, in larger size vessels, and through tissue with capillary vascularization. The results are compared to those obtained by using the bioheat model.