Mette Olufsen
North Carolina State University, Raleigh NC
e-mail: msolufse@ncsu.edu

Modeling and parameter estimation in cardiovascular dynamics

The main role of the cardiovascular system is to maintain adequate oxygenation of all tissues. This is accomplished by maintaining blood flow and pressure at a fairly constant level and transporting blood from the heart to the periphery with a minimal loss of energy. In addition, a number of control mechanisms are imposed regulating vascular resistance, compliance, pumping efficiency and frequency. In cardiovascular diseases, both the transport system and its regulation may be compromised, and for a number of diseases it is either not known or difficult to study what mechanism that lead to the breakdown of homeostasis. Typically, some general observations can be made, but these vary significant between individuals. Furthermore, for most patients only a few quantities can be measured, making it difficult to assess essential quantities such as cerebral vascular resistance, cardiac contractility, or the gain and time constants associated with the regulation. This presentation will discuss development of patient specific models obtained by combining models predicting control of blood flow and pressure with parameter estimation techniques. Models analyzed are composed of systems of nonlinear equations each specified via a set of model parameters. Nominal parameter values are obtained from analysis of populations and data available. Subsequently, sensitivity analysis, correlation analysis, and subset selection, are combined with parameter estimation techniques to obtain a subset of patient specific parameters.