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Mathematical Modeling of Physiological Systems

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This paper reviewed mathematical models of brain, heart, spinal column and human growth with an emphasis on the mathematical, the physical and the computer science concepts involved (Fig. 1). The models of brain were based on generalized theory of driven harmonic oscillator. Study of group structure

Modeling of global-electrocortical activity of brain
The human heart modeled as ellipsoid of revolution
3-D-static modeling of the human spinal column
3-D-dynamic modeling of the human spinal column
Modeling of child growth-and-obesity

Fig. 1. Modeling of physiological systems

has provided mathematical definition of brain death (Fig. 2). Model of heart was based on standing-wave

The covariant model
The generalized-coupling model
The covariant-generalized-coupling model
Mathematical definition of brain death

Fig. 2. Modeling of global-electrocortical activity of the human brain

concept. In addition, static and dynamic models of the human spinal column were presented. The models generate three-dimensional profile of the human spinal column from noncontact, noninvasive, measurements obtained from moiré contours. Moiré fringe topography is a stereophotogrammetric technique, which gives three-dimensional information of any curved surface (Fig. 3*a*). Rasterstereography gives local curvatures of the surface (Fig. 3*b*). A combination of these techniques is applied to study posture and gait of child, detect and quantify curvatures of spinal column and aid orthopedic surgeons in operations by providing 3-D maps of bony structures to be operated (Fig. 3*c*). A model of child growth was described, which included a method to generate detailed growth-and-obesity profile of a child on the

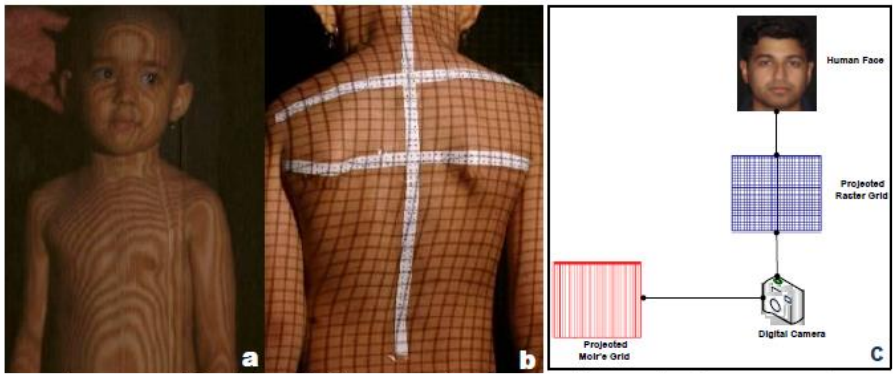

Fig. 3*a*-*c*. (*a*) Moiré fringe topography, (*b*) rasterstereography and (*c*) combination of these techniques

basis of records of height and weight of child, six-month apart as well as heights and weights of biological father and biological mother. Problems and challenges, which could be taken up by twenty-first-century mathematicians, were also discussed.

Keywords: Mathematical definition of brain death • Modeling of brain • Modeling of child growth • Modeling of heart • Modeling of spinal column • Moiré fringe topography • Rasterstereography

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