1051-92-184 **Andrew Gillette*** (agillette@math.utexas.edu), Department of Mathematics, University of Texas at Austin, 1 University Station C1200, Austin, TX 78712, and **Alexander Rand** and **Chandrajit Bajaj**. *Multi-scale Modeling of Electric Activity of Spiny Dendrites in the Hippocampus.*

Multiple types of brain injury and disease, such as epilepsy and genetic disorders leading to mental retardation, have been observed in combination with significant changes in shape, distribution, and prevalence of abnormal composition of dendritic spines in the hippocampus. Simulating the effect of neuronal modification in a computational model requires an accurate representation of *in vivo* neuronal geometry as well as stable methods for modeling electrical activity in the brain. Such electrical activity is governed by electrodiffusion partial differential equations at nanometer scales and by simplified versions of Maxwell's equations at micron scales. We will present the framework of Discrete Exterior Calculus (DEC) analysis to formalize geometric and functional constraints implied by the two sets of governing equations. The DEC analysis additionally guides the construction of stable polynomial bases and Whitney interpolants to be used for a consistent and robust simulation of the relevant ionic currents and varying membrane voltage potentials. This approach helps elucidate the relevant coupling structure and function parameters between the multi-scale sets of governing equations along with the dependence of electric activity on the spiny nature of dendrites. (Received August 24, 2009)