1142-49-39 **Andreas Mang*** (andreas@math.uh.edu), University of Houston, 3551 Cullen Blvd., 641 Philip G. Hoffman Hall, Houston, TX 77204, and **Klaudius Scheufele**, **Shashank Subramanian**, **Miriam Mehl** and **George Biros**. *Optimal control of PDEs: Application to brain tumor modeling.*

We present an optimal control formulation for patient-specific simulation of tumor progression and effective, parallel algorithms for its solution. The inputs to our problem are two sets of probability maps of brain tissue types obtained from magnetic resonance images, one of a brain tumor patient and the other one of a normal brain (no tumor). In the inverse problem, we seek tumor growth parameters and a deformation map from the normal to the abnormal brain so that the tumor predicted by our simulation and the deformed anatomy match the tumor and anatomy seen in the patient image. This problem presents us with numerous mathematical and computational challenges, including non-linearity, non-convexity, and inherent ill-posedness of the inverse problem, an expensive parameter-to-observation map, a strong coupling between mixed-type, multiphysics PDE operators, inhomogeneous material properties with sharp contrasts, a complicated geometry, and uncertainties in the data, model parameters, material properties, and the model itself. We will discuss strategies to tackle these challenges. We will study numerical accuracy, the rate of convergence, quality of the inversion, and scalability of our solver on synthetic and real-world data. (Received August 20, 2018)