1154-92-77 **Jun Liu** (juliu@siue.edu), Department of Mathematics and Statistics, Southern Illinois University Edwardsville, Edwardsville, IL 62026, and **Xiang-Sheng Wang*** (xswang@louisiana.edu), Department of Mathematics, University of Louisiana at Lafayette, Lafayette, LA 70503. *Optimal control of a size-structured model for metastatic cancer treatment.*

We propose a unified size-structured PDE model for the growth of metastatic tumors, which extends a well-known coupled ODE-PDE dynamical model developed and studied in the literature. A treatment model based on the proposed unified PDE model is investigated via optimal control theory, where its first-order necessary optimality system characterizing the optimal control is derived. We prove that the uniqueness of the optimal control depends on the chosen objective functional, and the optimal control is of bang-bang type when it is unique. For obtaining its efficient numerical solutions, a projection gradient descent algorithm based on the characteristic scheme is developed for solving the established optimal treatment model. Our study reveals that: (i) only the total drug dosage matters if one just cares about the final treatment output; (ii) given the same total drug dosage, the optimal bang-bang treatment plan outperforms the others in the sense that it maximally reduces the total tumor sizes during the whole period of treatment, although their final tumor sizes are the same. (Received July 30, 2019)