1106-35-117 **Ugur G Abdulla** (abdulla@fit.edu), Mathematical Sciences, Florida Institute of Technology, 150 W University Blvd, Melbourne, FL 32901, and **Nicholas Crispi**, **Jonathan Goldfarb** and **Daniel Kassler*** (dkassler@uchicago.edu), Dept of Mathematics, University of Chicago, 5734 South University Ave, Room 208C, Chicago, IL 60637, and **Scott Pelton-Stroud**, **Bruno Giuseppe Poggi** and **Paige Elizabeth Williams**. *On some inverse free boundary problems for second order parabolic PDEs.*

Consider the inverse Stefan problem (ISP), an inverse free boundary problem for a general second order linear parabolic PDE. The problem arises when considering phase transition processes with unknown temperature function and phase transition boundaries along with source term or boundary heat flux. We follow a new variational formulation developed in *U. G. Abdulla, Inverse Problems and Imaging, 7,2(2013),307-340* and reformulate ISP as an optimal control problem for the minimization of the L_2 declination of traces of a state vector with the unknown flux and the free boundary as controls. This formulation reduces the effect of measurement errors and needs to solve only a Neumann problem at each step of the minimization process. To prove existence, and provide a numerical method for solution of ISP, we consider a fully discrete problem. We prove well-posedness of the problem in the Sobolev spaces framework, and that interpolated solutions of the discrete problem converge weakly in Sobolev-Hilbert space H^1 to a solution to the Neumann problem via the derivation of two energy estimates for the discrete problem. We further prove that the discrete optimal control problems converge to the continuous problem with respect to functional and with respect to control. (Received July 21, 2014)