1116-35-87 **Ugur Abdulla** and **Curtis Earl*** (cearl2013@my.fit.edu), 2920 Emory st., Melbourne, FL 32901, and **Chelsey Hoff**, **Jim Jones**, **Bruno Poggi** and **Ryan Stees**. *State Constrained Optimal Control of the Stefan Type Free Boundary Problems.*

We consider an inverse free boundary problem, the inverse Stefan problem (ISP), for the general second order linear parabolic PDE

$$(a(x,t)u_x)_x + b(x,t)u_x + c(x,t)u - u_t = f(x,t)$$

where u is the temperature, f is the density of heat sources, and a, b, and c reflect non-homogeneity of the media. The ISP arises when considering a phase transition process with unknown temperature function, phase transition boundary, source term and boundary heat flux. We follow a variational formulation developed in *U. G. Abdulla, Inverse Problems and Imaging, 7,2(2013),307-340.* We pursue the same formulation with additional state constraint $u(x,t) \leq u_*$. We reformulate the ISP as an optimal control problem, with the source term, flux, and free boundary as controls, which minimizes L_2 declinations of traces of a state vector and a penalty term

$$\int_0^T \int_0^{s(t)} |\max(u(x,t) - u_*; 0)|^2 dxdt.$$

We use a Sobolev spaces framework and prove that the penalty functional is continuous in a weak topology in the space of weakly differentiable functions, implying existence of the optimal control. We pursue discretization and prove convergence of the sequence of discrete optimal control problems to the continuous problem. (Received July 20, 2015)