ELSA HANSEN, Queen's University, Kingston, Ontario
Optimal Control of Epidemics Using Limited Resources

We discuss different time-optimal control strategies for the basic *SIR* model with mass action contact rate. Among other things, the solution to an optimal control problem will depend on the cost function that the control is designed to minimize. In the literature, optimal vaccination-only policies and isolation-only policies that minimize cost functions that penalize for using control resources, have been given for the basic *SIR* model. We discuss the slightly different problem of finding optimal control strategies under the constraint of limited resources. Practically, this can be viewed as finding the best strategy, given that there are a limited amount of funds with which to implement vaccination and/or isolation. In addition to addressing this question for the vaccination-only and isolation-only models, we also present a solution for two different versions of a combined vaccination-isolation model. First we find the optimal combined policy under the assumption that the total vaccination and isolation resources have been separately allocated. Secondly, we give the solution for the case when only the total amount of resources have been allocated and the policy-maker is free to choose how to divide these resources between vaccination and isolation. For example, when planning for an epidemic, funds can be used to stockpile vaccine or prepare isolation facilities. A major advantage to using the basic *SIR* model to address these questions is that the basic forms of the solutions can be found without using numerical simulations and can often be understood using simple graphical explanations.