1147-49-312 **Bernard Bonnard***, 9, avenue Alain Savary, 21000 Dijon, France, and **Jérémy Rouot**, 2 rue F Sastre, 10430 Troyes, France. *Graphs, Singularity Theory and Optimal Control of Chemical Reaction Networks.*

In this talk we consider the problem of optimizing the yield of mass conservation chemical reactions networks where the control is the temperature. The system is described by the Feinberg-Horn-Jackson graph and at constant temperature under the so-called deficiency zero assumption, the dynamics split into two simple cases : in the non weakly reversible case there exist no equilibrium point nor periodic trajectory and in the other case, in each positive stoichiometric class there exists a single equilibrium which is (at least locally) asymptotically stable. To optimize the production of one of the chemical species we can control the temperature during the batch time and even for simple schemes the optimal control problem can be very complicated. We present general tools from geometric control to compute the optimal closed loop control based on Pontryagin maximum principle and singularity analysis of non smooth Hamiltonian systems. A concept of complexity is introduced to classify the optimal control problems and it is discussed in relation with the chemical reaction network for some specific schemes which appear in chemical engineering and in biology, like a sequence of irreversible reactions or the McKeithan network. (Received January 18, 2019)