STABILITY OF AN ADAPTIVE
CONTROLLED REACTION PATHWAY

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Single celled organisms such as bacteria and yeasts are able to tune enzyme levels that catalyze the reaction pathways by which they eventually make new copies of themselves. Depending on nutrient conditions, more or less enzyme is invested in different parts of their reaction network, so that reaction rates are constantly high, and cellular growth rate is maximised. In this talk I will present an analysis of a reaction network coupled to a set of equations for synthesis and degradation of enzymes involved in this network. These enzyme equations are designed such that the steady state flux through the network is optimal when it is in steady state. The resulting dynamical system is an ODE system with two sets of algebraic equations attached. Analysing it feels like playing two games of chess simultaneously, with strings between the chess pieces of the two boards! I will discuss the challenges to analyse this system, including quasi-steady state analysis, local stability, and if we have succeeded by the time of this conference, also global stability. In the process, we will uncover an intriguing function which gives direct access to many questions regarding this dynamical system.