

## Model Predictive Control (MPC) on a chip

### Motivation

Model Predictive Control (MPC) has become an established control technology in the petrochemical industry. Its use is currently being pioneered in an increasingly wide range of industries, including high bandwidth applications, such as ships, aerospace and road vehicles. Another motivating force for this project was the trend in miniaturization of machines which traditionally occupy a large volume space into chip scale level. There will be increasing demand for sophisticated control systems to be embedded into these micro machines to achieve integrated "laboratory-on-chip" devices. A case in point is the concept of a biochip for biological and chemical analysis. (98 words)

### Objective

To promote the embedded MPC technology, a set of tools which could take a MPC solution from design to embedded implementation in a cost effective manner will be developed. (29 words)

### Scope

MPC requires heavier computational load because it involves solving online constrained optimization problems. To employ MPC in high bandwidth and/or embedded applications where computational complexity is likely to be an issue, new MPC algorithms are proposed. The encapsulation of the MPC algorithms as suitable modules for embedded control is investigated. (50 words)

### Innovative Ideas

By focusing on issues related to encapsulating advanced control strategies such as MPC on an embedded system or a chip, we hope that the resulting design would contain the blueprint for the fabrication of control systems which could be integrated in miniaturized devices. (43 words)

### Demonstrable Activities

As the title suggests, one of the major goals of the "MPC on a chip" project is to make Model Predictive Control techniques accessible to the domain of real-time embedded applications. We aim to develop tools and modules that will enable quick and flexible deployment of advanced control strategies to meet the demands of high bandwidth and embedded applications. (59 words)

### Principal Investigator

Dr Keck-Voon LING  
Associate Professor  
School of Electrical and Electronic Engineering  
Nanyang Technological University  
50 Nanyang Avenue  
Singapore 639798  
E-mail: [ekvling@ntu.edu.sg](mailto:ekvling@ntu.edu.sg)  
Tel: +65 6790 5567 Fax: +65 6792 0415



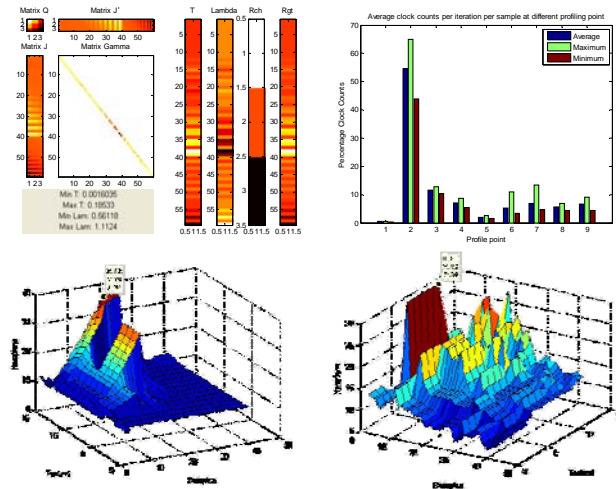


Figure 1. Optimization of the MPC algorithm

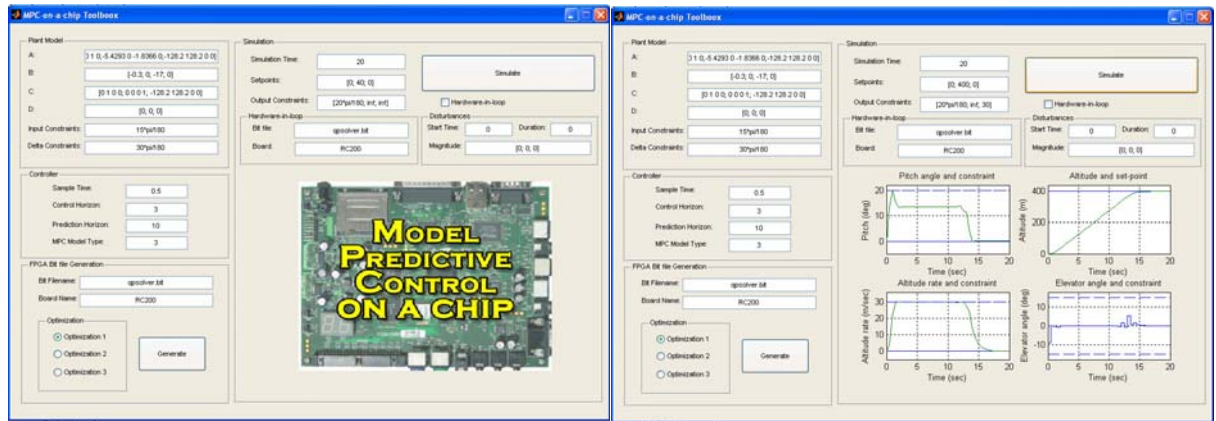


Figure 2. MPC-on-a-chip Toolbox

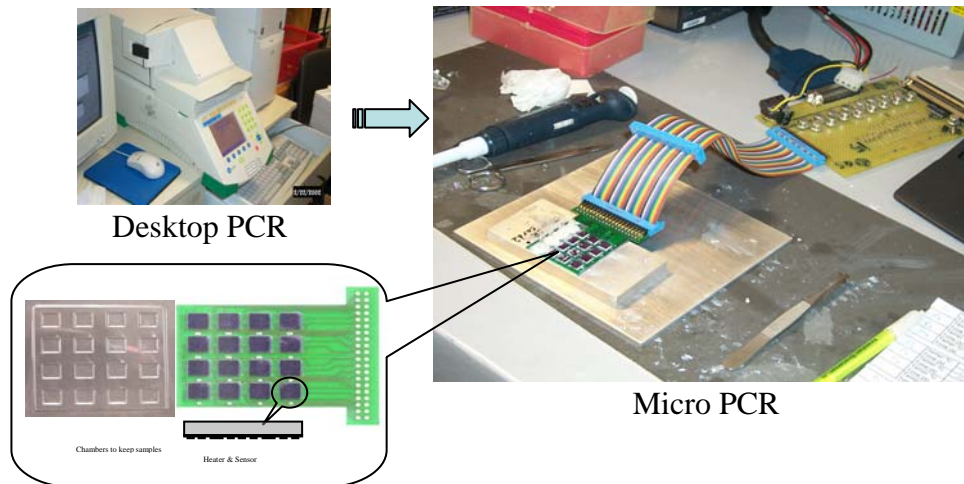


Figure 3. Miniaturized reactor leading to a "lab-on-a-chip" device with much faster, cheaper, portable and lower-power consumption