

Trajectory Optimization and MPC Application for a  
Building Model Identification  
Optimization of Mechatronic Systems

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# 1 Introduction

The following report is done with the purpose of demonstrating the skills and techniques learned throughout the Optimization of Mechatronic Systems lecture. With this in mind, an investigation on the thermal behavior of an apartment located in Leuven, Belgium was conducted. Three goals were in mind while conducting this project. First, an identification for a suitable model of the apartment (referred to as the ‘thermal zone’ or simply ‘zone’) temperature was done by means of a trajectory optimization problem. Once the model constants were identified, a model predictive control (MPC) application was made for the optimal deployment of the heating for the zone by means of a primal optimal problem statement. Finally, the same MPC application was developed using relaxed constraints by means of a lagrangian problem statement.

This section contains the description of the investigated thermal zone and the development of the zone model while all of the techniques used to solve the multiple problems investigated are explained exhaustively in section 2. Sections 3 and 4 contain the development, results and discussions over the problems while final comments and conclusions are discussed in section 5.

## 1.1 Thermal Zone

As mentioned in the previous paragraphs, an investigation is carried out for the thermal behavior and control of an apartment located in Leuven during the duration of the week of October 16 through 22, 2022. The inspiration for the apartment model is taken from the apartment pictured in Figure 1.



Figure 1: •

From Figure 1, it can be

## 2 Problem Statement

### 3 Trajectory Optimization

## 4 Model Predictive Control

## 5 Conclusions