



**University of Banja Luka**  
**Faculty of Mechanical Engineering**  
**Faculty of Electrical Engineering**



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## MODELING OF THE BUILDING THERMAL BEHAVIOUR USING NONLINEAR SYSTEM IDENTIFICATION

Vesna Ranković<sup>1</sup>, Milorad Bojić<sup>2</sup>, Jasna Radulović<sup>3</sup>, Danijela Nikolić<sup>4</sup>,  
Jasmina Skerlić<sup>5</sup>

**Summary:** Model-based predictive control is a very modern powerful control strategy that uses a model of the plant to predict its future behaviour and has been in focus of researchers in the area of buildings energy management. The aim of this paper is to develop and analyze NARX (Nonlinear AutoRegressive with eXogenous inputs) structure for the modeling of the building thermal behavior. A database was generated using simulation in EnergyPlus software. The NARX identification model was designed using the MATLAB System Identification Toolbox. The input variables analyzed in this paper are: outdoor temperature, heating or cooling power, and direct solar radiation. Simulation results demonstrate that the proposed nonlinear structure can be effective identification tool for development of nonlinear buildings predictive control.

**Key words:** building, NARX, identification, thermal behaviour

### 1. INTRODUCTION

Model predictive control (MPC) has been in focus of researchers in the area of buildings [1]. Model predictive control denotes a wide range of control techniques which apply a model to the prediction of future system behavior and calculate the control signals through the optimization of the objective function. The basic conditions that each model should satisfy are practical simplicity, well estimated system dynamics and satisfactory prediction properties.

Various deterministic approaches which uses knowledge of the structure and physical and material properties of a building and statistical procedures have been applied in order to derive a total model for the heat dynamics of a building. Deterministic models are based on energy and mass balance integral–differential equations and development of such type of model is a very time consuming task.

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<sup>1</sup>Ph.D., Vesna Ranković, Kragujevac, Faculty of Engineering, University of Kragujevac, (vesnar@kg.ac.rs)

<sup>2</sup>Ph.D., Milorad Bojić, Kragujevac, Faculty of Engineering, University of Kragujevac,  
(milorad.bojic@gmail.com)

<sup>3</sup>Ph.D., Jasna Radulović, Faculty of Engineering, University of Kragujevac, (jasna@kg.ac.rs)

<sup>4</sup>Assistant, Danijela Nikolić, Faculty of Engineering, University of Kragujevac, (danijelan@kg.ac.rs)

<sup>5</sup>Researcher, Jasmina Skerlić, Faculty of Engineering, University of Kragujevac, (jskerlic@gmail.com)









