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Application of Model Predictive Control (MPC) to Longitudinal Motion of the Aircraft Using Polynomial Chaos

K. D. R. Dewi, K. Fahim and S. Subchan *

Department of Mathematics, Faculty of Science and Data Analytics, Sepuluh Nopember Institute of Technology, Surabaya, Indonesia

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Abstract: Dynamical systems can be stochastic or uncertain because of some assumptions or distractions that limit the problem. This occurs when the system is obtained from data using system identifiers with various uncertainties. One example of a system that contains uncertainty parameters is the longitudinal motion of the aircraft model. The longitudinal motion of the aircraft requires control, so in this study, control was applied using the Model Predictive Control (MPC) method. Before applying control to the aircraft model, the Polynomial Chaos expansion will be applied to the state space model to get the deterministic model. The simulation uses different prediction horizons (N_p) and polynomial orders (r). Based on the simulation results, it was found that the pitch rate output can approach the given pitch rate reference.

Keywords: *polynomial chaos; hermite polynomial; model predictive control.*

Mathematics Subject Classification (2010): 33C45, 34H10, 93C15.

1 Introduction

Mathematical models are the representations of phenomena or realities written in mathematical equations. The process of constructing a mathematical model of reality or a problem is called mathematical modelling [1]. Mathematical models can be written in the dynamic system [2]. A dynamic system is a system that changes or experiences dynamics over time. In practice, dynamic systems are not always deterministic. The dynamic system can be stochastic because there are assumptions to limit the problem

* Corresponding author: mailto:Subchan@matematika.its.ac.id