

**THE DEVELOPMENT OF SIMPLE FUZZY SYSTEM USING  
VHDL**

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## ABSTRACT

This project describes the implementation of a fuzzy controller in Hardware-Description Language (HDL). The motivation behind the implementation of a fuzzy controller was driven by the need for an inexpensive hardware implementation of a generic fuzzy controller for use in industrial and commercial application. In this project, Very High speed integrated-circuit Hardware-Description Language (VHDL) has been used for the hardware description and this application is suitable for being implemented into an Application Specific Integrated Circuit (ASIC) or Field Programmable Gate Array (FPGA). This project will use Xilinx ISE as a synthesis tool and ModelSim for the simulation tool. The result from this project will be compared with the result that had been obtained from the MATLAB.

**Keywords:** Fuzzy Logic Controller, HDL, VHDL, ASIC, FPGA, Xilinx ISE, ModelSim.

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# CHAPTER 1

## INTRODUCTION

### 1.0 INTRODUCTION

The motivation behind the implementation of a fuzzy controller in VHDL was driven by the need for an inexpensive hardware implementation of a generic fuzzy controller for use in industrial and commercial applications. A very simple fuzzy controller is used to demonstrate this implementation. In the controller, an external device's information is converted into an output control signal to drive devices such as motors, actuators via the process of fuzzification, rule evaluation or known as rule base and also defuzzification.

### 1.1 FUZZY SYSTEM

Fuzzy logic was conceived as a better method for sorting and handling data but has proven to be an excellent choice for many control system applications since it mimics human control logic. It can be built into anything from small, hand-held products to large computerized process control systems. It uses an imprecise but very descriptive language to deal with input data more like a human operator.

Fuzzy logic describes complex systems using the knowledge and experience in simple English-like rules [6]. It does not require any system modeling or complex math equations governing the relationship between inputs and outputs. Fuzzy rules are very easy to learn and use, even by non-experts. It typically takes only a few rules to describe systems that may require several of lines of conventional software. As a result, fuzzy logic significantly simplifies design complexity. Fuzzy logic is a paradigm for an alternative design methodology which can be applied in developing both linear and non-linear systems for embedded control. By using fuzzy logic, designers can downsize development costs, superior features, and better end product performance. Furthermore, products can be marketed faster and more cost-effective [6].