

# Development a fuzzy controller for a steam generation plant using fuzzy cluster analysis

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## Abstract

An indirect method or fuzzy clustering algorithm is selected to build a linguistic fuzzy model of a steam generator controller. Based on output data clustering and projection onto the input spaces, number of clusters is determined and rules are generated automatically and a linguistic fuzzy MISO model is constructed. Then, by implementing an adapted neural Network for selected type of membership functions, all membership function parameters will be optimized. Compared to other algorithms, the proposed new algorithm and methods are computationally and conceptually simple. The obtained model will be compared with a conventional (PID) controller for a specified boiler.

**Key words:** Steam generator, Fuzzy control, Fuzzy clustering, Parameter identification, Neural networks

## 1. Introduction

The control of nonlinear and multivariable systems is of the main concerns in many industries. Nowadays, regarding to increasing complexity of manufacturing systems, the conventional control systems have reached their limitations. In thermal power plants, steam generators are good samples for a complex and multivariable plant. Regarding to characteristics of these plants, the continuous and safe operation are very important.

Development of new controllers, based on fuzzy logic, can solve existing control problems properly. The aim of this research is to implement Fuzzy Logic in control of a steam generation plant. Here, fuzzy logic offers a simple and easy comprehensible method to solve control problems successfully.

## 2. Plant description and control objectives

The drum-type boiler is the fundamental steam generator for both industrial and utility applications. The steam generated by a boiler may be used as a heat transfer fluid for process heating, or it may be expanded in steam turbines to drive rotating machinery such as fans, compressors, or electric generators. Figure (1) is a schematic representation of a drum-type boiler.

The steam drum and water drum are mounted in a furnace and are interconnected with water tubes called risers and down comers. The furnace includes one or more burners for the combustion of an air and fuel mixture. The heat release of combustion is transferred to the water tubes to generate steam. Steam bubbles form in the tubes (risers) closest to the burner and rise to the steam drum where they are separated from the water.