

SIMULATION OF CONTROL OF MULTI-VARIABLE CONTROL LOOP: STEAM TURBINE

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Abstract

The paper deals with the description and simulation verification of one of possible methods to control of multivariable control loops. In this case, the so called main controllers, binding members and correction members are used. The proposed method of control combines classical way to ensure of autonomy of control loop via binding members and the use of the method of single-variable branched control loops with measurement of dominant disturbance variables to ensure of invariance of control loop via correction members. Main controllers can be proposed by arbitrary synthesis method. Simulation verifications of the control method are carried out for three-variable loop of a steam turbine.

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Key Words: MIMO Control Loop, Synthesis, Autonomous Control, Invariant Control

1. INTRODUCTION

At large numbers of controlled systems several variables have to be controlled at the same time. The examples of these systems are e.g. air-conditioning plants, reactors, steam boilers, turbines, distillation columns, etc [1]. In these cases, it means that there is not only larger number of independent SISO (single-variable) control loop. These control loops are complex with several controlled variables where separate variables are not mutually independent. Mutual coupling of controlled variables is usually given by simultaneous action of each of input (manipulated and disturbance) variables of controlled plant to all output (controlled) variables. These control loops are called MIMO (multi-variable) control loops and they consist of mutually influencing simpler control loops [1-2]. Special case of MIMO control loop is SISO control loop having only one input signal (manipulated variable, disturbance variable) and one output signal (controlled variable) [3].

One of above-mentioned examples of multi-variable controlled system is a steam turbine [4-6]. In the experimental part of the paper is considered simulation example of three-variable controlled system of steam turbine [4]. Proposed method to control of the three-variable controlled system uses the so called main controllers, binding members and correction members [1]. The main controllers are designed via classical SISO synthesis methods (Ziegler Nichols step response method, method of desired model) [1, 7-10] and also via polynomial approach (pole placement method) for SISO control loop [11-12]. Binding members and correction members ensure autonomy of control loop and invariance of control loop. All simulation experiments were performed in the simulation mathematical software MATLAB/SIMULINK version 6.5 [13].

2. MULTI-VARIABLE CONTROL LOOP

It is considered multi-variable control loop with measurement of disturbance (see Fig. 1) where $G_S(s)$, $G_R(s)$, $G_{SV}(s)$ and $G_{KC}(s)$ are transfer matrixes of a controlled plant, controller,

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