LOGO WILL BE HERE

MASS FLOW RATE CHARACTERISTIC OF THE FLAPPER-NOZZLE PNEUMATIC VALVE

Pršić Dragan[1], Nedić Novak[2], Dubonjić Ljubiša[3]

Summary: *Flapper-nozzle type valve is commonly used for precision, flow control in pneumatic systems. For the purpose of analysis and design the paper is concerned with nonlinear mass flow rate of the valve taking into account different flow regimes. Flow rate is static, nonlinear function and could not be solved in analytical form. In this paper Particle Swarm Optimization method is used for numerical solution. Depending on supply pressure and flow area ratio along the static characteristic different segment can be observed.*
Key words: flapper-nozzle valve, mass flow rate characteristic, PSO optimization method

1. INTRODUCTION

Pneumatic servosystems are widely used in industrial applications because of the favourable performances/price ratio. However, high accuracy control of such systems is difficult due to their complex physical nature [1]. In order to solve the problem of design and control of such systems, it is necessary to have better understanding of their nonlinear characteristics. A mathematical model which should clarify the most relevant static and dynamic behaviour of the pneumatic system is used for that purpose.

Flapper-nozzle type valves are frequently used in pneumatic systems because of their simple structure, high precision, sensitivity and a broad bandwidth. They are usually used in control devices or measurement instruments. Different models of these valves can be encountered in the literature: starting from linearized algebraic equations to nonlinear dynamic models [2,3]. The paper analyzes the mass flow rate nonlinearity of the pneumatic flapper-nozzle type valve with high supply pressure. Various flow regimes are analyzed because when the supply pressure is higher than 0.15 [MPa], the air compressibility must be taken into consideration.

[1] Assist. Prof. Dragan Pršić, Serbia, University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, (prsic.d@mfkv.kg.ac.rs)
[2] Prof. Novak Nedić, Serbia, University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, (nedic.n@mfkv.kg.ac.rs)
[3] Assist. Prof. Ljubiša Dubonjić, Serbia, University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, (dubonjic.lj@mfkv.kg.ac.rs)