Self- sustained Oscillation Pulsed Air Blowing System for Energy Saving

CAI Maolin* and XU Weiqing

School of Automatic Science and Electrical Engineering, Beihang University, Beijing 100191, China

Received June 9, 2009; revised April 1, 2010; accepted April , 2010; published electronically April , 2010

Abstract: Currently, many studies have been made for years on dimensions of pneumatic nozzle, which influence the flow characteristic of blowing system. For the purpose of outputting the same blowing force, the supply pressure could be reduced by decreasing the ratio of length to diameter of nozzle. The friction between high speed air and pipe wall would be reduced if the nozzle is designed to be converging shape comparing with straight shape. But the volume flow and pressure, discussed in these studies, do not describe energy loss of the blowing system directly. Pneumatic power is an innovative principle to estimate pneumatic system's energy consumption directly. Based on the above principle, a pulse blowing method is put forward for saving energy. A flow experiment is carried out, in which the high speed air flows from the pulse blowing system and continuous blowing system respectively to a plate with grease on top. Supply pressure and the volume of air used for removing the grease are measured to calculate energy consumption. From the experiment result, the pulse blowing system performs to conserve energy comparing with the continuous blowing system. The frequency and duty ratio of pulse flow influence the blowing characteristic. The pulse blowing system performs to be the most efficient at the specified frequency and duty ratio. Then a pneumatic self-oscillated method based on air operated valve is put forward to generate pulse flow. A simulation is made about dynamic modeling the air operated valve and calculating the motion of the valve core and output pressure. The simulation result verifies the system to be able to generate pulse flow, and predicts the key parameters of the frequency and duty ratio measured by experiment well. Finally, on the basis of simplifying and solution of the pulse blowing system's mathematic model, the relationship between system's frequency duty ratio and the dimensions of components is simply described with four algebraic equations. The system could be designed with specified frequency and duty ratio according to the four equations. This study provides theoretical basis for designing energy-saving air blowing system.

Key words: energy saving, pulse blowing, self-sustained oscillation, pneumatic power

*Corresponding author. E-mail: caimaolin@gmail.com

E-mail: cjme@mail.machineinfo.gov.cn **http:** // www.cjmenet.com.cn