ABSTRAK

Ventilator mekanik sangat penting untuk mempertahankan hidup pasien dengan gejala gagal napas berat ataupun gagal napas ringan yang memerlukan bantuan pernapasan baik secara *invasive* maupun *non-invasive.* Sistem *ICU* ventilator merupakan salah satu alat bantu pernapasan yang bekerja secara *invasive* dimana penggunaannya dengan memasukkan alat bantu napas melalui mulut atau hidung pasien. *ICU* ventilator memiliki mode khusus *pressure control* yang memfokuskan pada tercapainya *pressure setpoint* pada saat pernapasan. *Pressure* inspirasi dan *flow* inspirasi merupakan variabel yang harus diatur dalam mode *pressure control* ventilator. Penelitian ini membahas mengenai perancangan pengendalian tekanan pada sistem inspirasi *ICU* ventilator. Kendali *PI* digunakan untuk mengendalikan *flow* inspirasi yang diberikan oleh sistem, untuk mencapai *pressure setpoint* pada saat inspirasi, *flow* inspirasi harus dihitung berdasarkan parameter *resistance* dan *compliance* pasien. Hasil pemodelan kendali *PI flow* udara, didapatkan parameter *Kp* = 1,1855 dan *Kd* = 24,68211. Hasil pemodelan kendali diuji pada pengujian berbasis simulasi dan implementasi. Pengujian simulasi menghasilkan rata-rata *rise time* 0,22971 s, *settling time* 0,76903 s, *overshoot* 0,60543 %, dan *error steady state* 0 %. Pengujian implementasi menghasilkan rata-rata *rise time* 0,553685 s, *settling time* 0,999423 s, *overshoot* 3,582655 %, dan *error steady state* 1,25516 %. Pengujian pengendalian tekanan menghasilkan eror rata-rata *pressure* inspirasi yaitu 1,89239 % dan eror *PEEP* yaitu 6,41321 %, dengan rata-rata tercapainya *pressure* inspirasi yaitu 1,83 siklus, dan *flow* inspirasi pada sistem stabil pada 5,83 siklus.

Kata kunci : *ICU* ventilator, *PI*, Inspirasi, Ekspirasi, *Proportional Flow Control Valve*, *Pressure*.

ABSTRACT

Mechanical ventilation is very important to maintain the life of patients with symptoms of severe respiratory failure or mild respiratory failure who require both invasive and non-invasive respiratory support. The ICU ventilator system is a breathing apparatus that works invasively where its use is by inserting a breathing apparatus through the patient's mouth or nose. The ICU ventilator has a special pressure control mode that is focused on achieving the pressure set point during breathing. Inspiratory pressure and inspiratory flow are variables that must be adjusted in the ventilator pressure control mode. This study discusses the design of pressure control in the ICU ventilator inspiratory system. PI control is used to control the inspiratory flow provided by the system, to reach the setpoint pressure during inspiration, the inspiratory flow must be calculated based on the patient's resistance and compliance parameters. The results of PI air flow control modeling obtained parameters Kp = 1,1855 and Kd = 24,68211. The results of the control modeling were tested on simulation-based testing and implementation. The simulation test resulted in an average rise time 0,22971 s, settling time 0,76903 s, overshoot 0,60543 %, and steady state error 0 %. The implementation test resulted in an average rise time of 0,553685 s, settling time of 0,999423 s, overshoot of 3,582655 %, and steady state error of 1,25516 %. The pressure control test resulted in an average inspiratory pressure error of 1,89239% and PEEP error of 6,41321 %, with an average inspiratory pressure achievement of 1,83 cycles, and the inspiratory flow in a stable system at 5,83 cycles.

Keyword : ICU ventilator, PI, Inspiration, Expiration, Proportional Flow Control Valve, Pressure.