

Generator sinkron merupakan komponen utama dalam sistem tenaga listrik untuk menghasilkan daya listrik. Untuk menjaga kinerjanya yang penting, monitoring dan kontrol diperlukan dengan memanfaatkan *state* dinamis pada generator. Namun, saat ini *state* dinamis seperti sudut rotor, perubahan kecepatan sudut rotor, dan tegangan internal pada sumbu dq tidak dapat diukur secara langsung. *State* dinamis ini dapat diestimasi melalui pengukuran terminal *output* yang mencakup daya aktif dan daya reaktif.

Oleh karena itu, diperlukan metode untuk mengestimasi *state* dinamis berdasarkan data seperti tegangan dan daya *output*. Metode yang digunakan adalah *Extended Kalman Filter* (EKF) dan *Particle Filter* (PF). Dalam skripsi ini, performa estimasi EKF dan PF akan dievaluasi dengan menggunakan *Mean Squared Error* (MSE) sebagai indikator. Selain itu, akan dianalisis pengaruh adanya gangguan *step function* pada *input* generator sinkron, yaitu T_m , dan dampak dari *noise* dalam sistem terhadap performa estimasi EKF dan PF.

Secara umum, memperkirakan keadaan model generator sinkron menunjukkan bahwa dalam menghadapi variasi *measurement noise*, *Particle Filter* memberikan performa estimasi *state* yang baik. Ketika menghadapi variasi *process noise*, *Extended Kalman Filter* juga memiliki performa yang baik dalam estimasi *state*. Selain itu, ketika terjadi variasi gangguan/*fault* pada T_m , *Particle Filter* tetap mampu memberikan performa estimasi *state* yang baik.

Kata kunci : Generator Sinkron, Estimasi, *Measurement Noise*, *Process Noise*, *Extended Kalman Filter*, *Particle Filter*

ABSTRACT

The synchronous generator plays a crucial role in the power system as the primary source of electrical power generation. To ensure its stable operation, monitoring and control are necessary, by utilizing the dynamic state of the generator. However, the dynamic state variables such as rotor angle, rotor angle velocity changes, and dq-axis internal voltage components cannot be directly measured at present. These dynamic states can only be estimated through the measurement of terminal outputs, which include active power and reactive power.

Therefore, a method is required to estimate the dynamic states based on the available data. The methods employed for this purpose are the Extended Kalman Filter (EKF) and Particle Filter (PF). In this research, the performance of the EKF and PF estimations will be evaluated using mean square error as an indicator. In addition, it will analyze the effect of disturbances step function on input of the synchronous generator, namely T_m , and the impact of noise in the system on the performance of EKF and PF estimates.

In general, estimating the state of the synchronous generator model shows that in dealing with variations in measurement noise, Particle Filter provides good estimation performance of state. When dealing with variations of process noise, Extended Kalman Filter also has good performance in estimating state. In addition, when there is a variation of disturbance/fault on T_m , Particle Filter is still able to provide good performance estimation of state.

Keywords : *Synchronous Generators, Estimation, Measurement Noise, Process Noise, Extended Kalman Filter (EKF), Particle Filter (PF).*