

ABSTRAK

Pengembangan simulator turbin angin guna meningkatkan fleksibilitas penelitian elektronika daya dan *maximum power point tracker* (MPPT) telah masif dilakukan. Simulator turbin angin merupakan motor listrik yang torkanya dikendalikan berdasarkan karakteristik turbin, sehingga kualitasnya sangat bergantung pada Persamaan matematika turbin yang digunakan. Hal tersebut membuat pengembangan Persamaan matematika turbin angin menjadi sangat krusial. Pada penelitian ini dilakukan persamaan matematika untuk turbin NREL-S823 menggunakan metode regresi non-linear dengan empat kandidat fungsi basis diantaranya fungsi kuadrat, fungsi kubik, satu fungsi basis radial gaussian, dan dua fungsi basis radial gaussian. Data referensi yang akan diregresi pada penelitian ini didapat dari hasil analisis performa aerodinamik turbin NREL-S823 menggunakan *blade element momentum*, *LLFVW* dan *potential flow theory*. Hasil regresi menunjukkan bahwa dua fungsi basis radial gaussian memiliki tingkat kecocokan paling tinggi dengan nilai koefisien determinasi 0,99 dan RRMSE 0,002. Persamaan matematika juga telah diintegrasikan dengan motor listrik terkendali torka secara simulasi maupun eksperimen dan menunjukkan hasil yang baik.

Kata kunci: Simulator turbin angin, persamaan matematika, regresi non-linear



ABSTRACT

The development of wind turbine simulators to increase the flexibility of power electronics research and maximum power point tracker (MPPT) has been massively carried out. A wind turbine simulator is an electric motor whose torque is controlled based on the characteristics of the turbine, so the quality is very dependent to the mathematical equation used. This makes the development of wind turbine mathematical equations very crucial. In this study, a mathematical equation was carried out for the NREL-S823 turbine using a non-linear regression method with four base function candidates including second order polynomial, fourth order polynomial, one gaussian radial base function, and two gaussian radial base functions. The reference data to be fitted in this study was obtained from the results of aerodynamic performance analysis of the NREL-S823 turbine using blade element momentum, LLFVW and potential flow theory. The regression results showed that two gaussian radial base functions have the highest match with a coefficient of determination value of 0.99 and RRMSE of 0.002. Mathematical equations have also been integrated with torque controlled electric motors in simulations and experiments and show good results.

Keyword: Wind turbine simulator, mathematical equation, nonlinear regression

