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VARIABLES AND OPTIMAL SIZE OF THE ENERGY STORAGE–FLYWHEEL

Mohamed M.Alhneaish[1],Ahmed O.Amhamed[2], Nafaa A.Albohli[3]
[1,2,3] Department of Mechanical Engineering, Faculty of Engineering, Sabratha University, Libya
[1]elhneaish@yahoo.com, [2]ahmed_dbash@yahoo.com, [3]nafaa.albohli@yahoo.com

ABSTRACT

The need for more environmentally, friendly, cost-effective, and renewable energy sources, has led to continuing the development of electromechanical devices such as the flywheel. Flywheels is a device which stores electrical energy in the form of kinetic energy, and it has the advantage of high power output and long life spans, but it is usually large and expensive system used in industry. Flywheel Energy Storage System (FESS) rekindles wide range interests among researchers as one of the best options for storing the extra AC power for later use. When flywheels acts as a networked storage device, its ability of controlling the network stability is very important because it must explain the sudden uncertainty resulting from random changes in wind speed, which is necessary for Wind Energy Conversion Systems (WECS) to function as a traditional source to support the electrical network. The ability to control the flywheel energy storage system and its effectiveness in supporting the electricity grid is closely related to its size. The main objective of this paper is to design the flywheel that achieves performance requirements with the lowest possible use of materials in terms of mass and volume. The optimal design of four different materials will be carried out to find the minimum mass required for the same energy storage values as they are installed in wind turbine with power 2.5 MW. Genetic algorithm in MATLAB® environment was proposed to solve the nonlinear objective function to obtain optimum values for mass and size of the flywheel. The results showed that this improvement led to find the minimum mass and the optimum size of the flywheel, and the simulation results showed the desired goal in terms of reducing the fluctuations of energy was obtained.

Keywords: Flywheel, Optimal Design, Energy Storage Systems.