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Improving the plan and execution of a high-voltage super durable magnet generator with a two fold stator

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ABSTRACT: For marine current energy applications, this research examines direct drive optimization and control using Double Stator Permanent Magnet Generators (DSPMG). Tidal energy conversion projects and common conversion chains are briefly discussed in this article. First, turbines are briefly discussed. With a revolutionary multi-objective generator design technique that considers tidal speed, control strategy, and converter size, it was constructed. DSPMG's conceptual advantages may turn an open phase defect into a continuous operation. A fault-tolerant and optimized control system may be useful. Surface-mounted permanent magnet motors in good and poor health are utilized to eliminate torque ripple. The inquiry focuses on the stator short circuit between revolutions. The research offers a motor dynamic equation-based paradigm. Altering motor power supply control based on simulation findings for defects or imbalances is conceivable. Torque ripple may be decreased.

Introduction

Wind, geothermal, solar, and ocean energy are among the most sought-after renewable energy sources for ensuring future energy security while still adhering to the Kyoto treaty. Ocean renewable energy is a major sector. Although they span more than 70 percent of the planet, seas may provide far more energy than any other source on the planet. Global ocean resources are projected to be between 2, 000 and 4, 000 TWh per year, according to authoritative sources [1].

Wave energy, tidal energy, osmotic energy, ocean thermal energy, and marine biomass culture are among the most well studied and widely used methods for harvesting ocean energy. For this reason alone, marine current power is a more appealing alternative to other forms of renewable energy [2].

Marine current energy offers enormous potential in France, which is bolstered by strong R&D and industrial capabilities[3]. The French government, labs, and enterprises work to construct a full research and development system that includes financing, source modeling, experimentation, generator design, converters, transmission, and grid integration.

The following is the structure of the paper, which is based on the work that has been completed to date.

1. Marinecurrentenergy

Principle, advantages and, challenges

Since marine current energy can be predicted to an unprecedented degree of precision across decades compared to other forms of renewable energy, it is a viable resource option[8]. Current weather conditions may have an enormous impact on other renewable power projections, but this is not the case here.

There is another essential aspect of marine currents, which is their low speed compared to wind because of the low density and cube of velocity, which results in a much higher kinetic power density (800 times more than air density). For example, a marine current turbine may be a tenth or twenty percent smaller and lighter than the equal rated power of a wind turbine.

It's easy to see how marine current energy may be harvested using the same fundamental physical principles as wind energy. Similar strategies created for Wind Energy Conversion Systems have been suggested by several researchers (WECS). As a result of these and other factors, the design of a Marine Current Turbine (MCT) is a difficulty. Due to the increased density of water, a special focus is paid by the MCT to its shorter and thicker blades than Wind Turbines. [10]

Hydrodynamic power can be recovered only a small amount, no matter how well-designed a turbine is. This ratio of recoverable power can be described using a metric known as Cp or Betz's coefficient.

Table 1. Analysis of SPMSM inductances and resistors yielded the following results:analyticallyin (a)healty and(b)faulty case

L_S(H)	M(H)	R_S(Ω)
0.0746	-0.0312	3.6

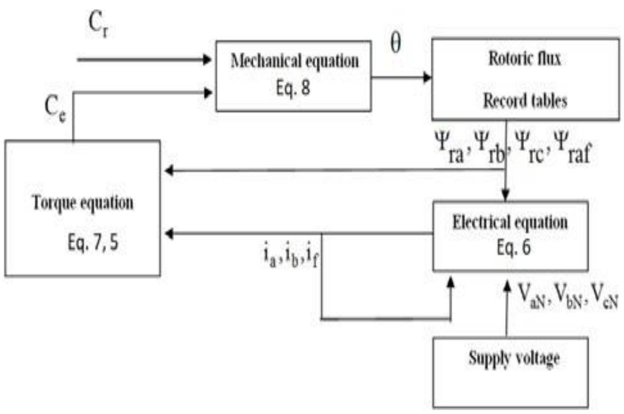
(a)

L_s(H)	M(H)	L_{af}(H)	L_{a2}(H)	M_{afa2}(H)	M_{afb} □ M_{afc}(H)	R_s(Ω)	R_{af}(Ω)
0.0746	-0.0312	0.00569	0.0064	0.0056	-0.0052	3.6	0.6

(b)

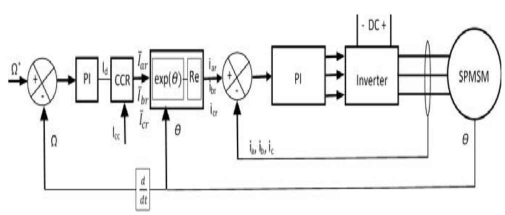
Classifying MCT devices can be difficult due to the wide range of options available. Using a motion-based classification system, these gadgets will be grouped together in this research article. It is thus possible to classify all of the numerous models accessible in this way:Oscillating Hydroplane Systems ; Horizontal Axis Turbines;Vertical Axis Turbines.

Most prevalent is a horizontal-axis marine



current turbine (MCT). A turbine's blade pitch may be fixed or variable, enabling it to run in both directions (Rourke et al., 2010). Due to prototypes and commercial initiatives, various technical challenges are becoming harder. Installation, maintenance, packing density, and fouling are major difficulties for researchers.

2. Simulation principle of healthy and faulty machine



It's possible to see the simulation's block diagram in Figure 2. The rotor flux and stator currents are used to calculate the electromagnetic torque in this case. A rotor's location may be determined by using the mechanical equation that describes it. It is possible to get the rotor flux from recording tables by plotting it against rotational angle. To calculate SPMSM currents, one must use electrical equations.

Each phase's rotor flux values are derived from the integration of electromotive forces that may be detected realistically when the alternator is functioning.

An electronic control loop is used to study the effect of supply current changes on torque ripple. As seen in Figure 3, the CCR block, which is discussed in the next section, determines iar, ibr, and icr in the control loop shown there (In Figure 5).

Figure2.The SPMSM model's block diagram for simulation purposes.

Figure3. PMSMcontrolloop

3. Horizentalaxisturbinesa ndusualgenerators

Horizontal axis systems have been the subject of several initiatives and concepts that have been tried. Direct Drive Train System, which relies mostly on synchronous generators and includes induction and permanent magnet synchronous engines, is distinct from the existing marine current systems, which may be further classified into two categories: gear-driven and non-geared.

As a result, Seagen S and HS1000 – the world's first grid-connected commercial and precommercial projects – both used induction generators for their induction generators, which were erected in Strangford, Northern Ireland, in May 2008 and have been owned by Siemens since 2012. A gearbox connects the induction generators on either side of the Seagen's two 16-meter-diameter axial flow rotors. It is possible to run these two turbines separately. It is possible for the rotors to work with flood and ebb tides because of their proprietary full span pitch control. Rotors may be elevated above the water level for safe and simple maintenance access. Since it was installed, the Seagen has already produced 8GWh of power in its first year of operation.

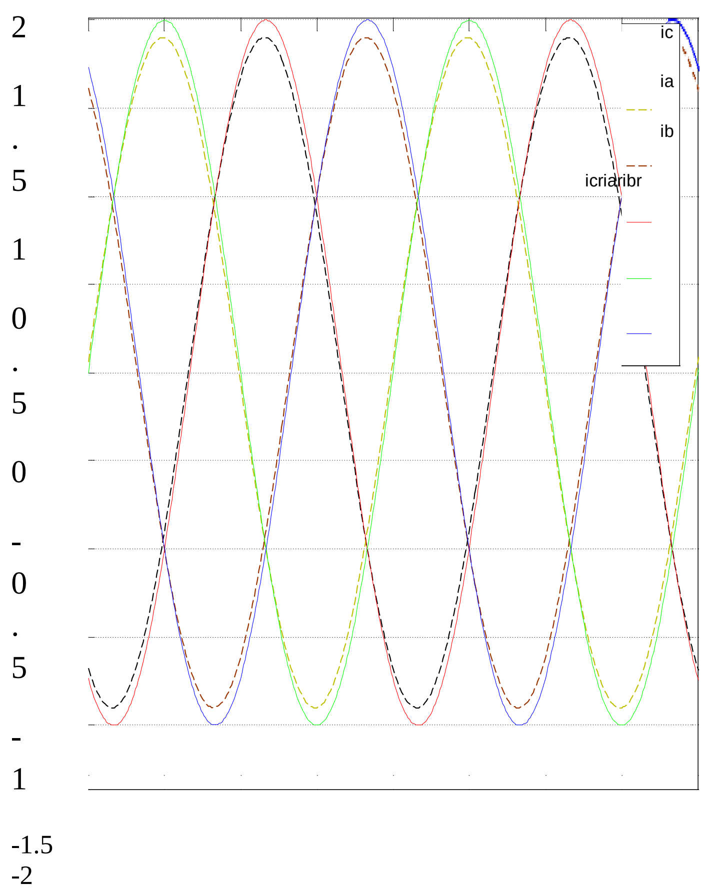
Figure 3.Seagenturbine

Figure4.HS1000

4. Simulationresults

An implementation of the motor model in Matlab/Simulink is shown in appendix 1. It is made up of six basic coils for each stator winding It's during the winding phase A that the first elementary segment develops a short-turn defect (Figure 1). employing a 50Hz current-balanced system in both healthy and problematic scenarios, as well as a 50Hz motor with the currents regulated using (17). PWM inverter current impact is hidden in simulation as a consequence of this. During the simulations, which are performed in a stationary working environment, no load is placed on the equipment.SPMSM that is nourished by a steady flow of currents

Figures 6-8 show the torque and speed of electromagnetism (references and controlled current). To get a 2A peak direct system, we need to match the currents to the references with some degree of precision. We can plainly perceive an electromagnetic torque and speed that is constant and continuous.



8 8.005 8.01 8.015 8.02 8.025 8.03 8.035 8.04
Time (s)
Figure 6. Balanced stator currents supplying the healthy SPMSM: referenceand supply currents.

5. Conclusion

In this research, the topic of marine current energy was addressed. The technological challenges, turbine concepts, and generator/converter interfaces used to classify diverse projects. Based on this research, it seems that direct drive systems are the best choice for marine current energy conversion.

Next, we investigate a typical conversion chain utilizing a dual stator PMG. A novel strategy for reducing machine and converter loss has improved system efficiency across the board (MPPT and flux weakening regions). This chain's investment and energy extraction have been optimized for 20 years to account for sea current speed.

Finally, the chain's reaction to an open phase defect is investigated. A fault-tolerant control is presented to create a smooth torque, equal to the one under normal conditions, and reject undesirable torque ripples. The simulation results revealed a broad variety of options for dependable maritime power generating. Surface Permanent Magnet Synchronous Motors have been proposed as a model for modelling torque ripple in healthy and problematic conditions.Current references are provided that may be utilized to feed each phase of the motor so that torque variance during a malfunction can be minimized for certain applications.There seems to be a correlation between motor torque ripple and a short circuit in the stator. It has been shown that the torque ripple may be decreased using an unbalanced current control method applied in the motor phases. Low-power equipment may be used to show this principle but it still applies to more powerful machines like autos.

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