Maestría en Ingeniería en Automatización de Procesos Industriales

Title

Automation of a system generation of electric energy starting the energy coming from the waster steam

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September-December 2016

Automation of a system generation of electric energy starting from the energy coming from the water steam.

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1. Introduction

The generation of electric energy, through renewable energy, represents in our country an important opportunity to be able to meet the challenges of generation and distribution of electricity in places where it has not been able to reach [1].

The present work shows the operation of the proposed PID control system (PID IO) that uses the energy provided by the steam water generated by a parabolic channel solar concentrator [2]; It will be very useful for students of the Universidad Politécnica de Puebla to propose and test new models of electronic control [3], as well as make continuous improvements to the prototype.

2. Objectives

2.1. General objective

To automate the system of electric power generation by taking advantage of the water steam produced by a parabolic channel solar concentrator.

2.2. Especific objetives

- To design and implement the system for conditioning the electric energy obtained from the electric generator driven by the steam turbine produced with solar energy.
- To design and implement a DC-DC converter to maximize the use of the generator's electrical energy.
- To integrate the DC-AC converter to the generator and connect it to a load

3. Method

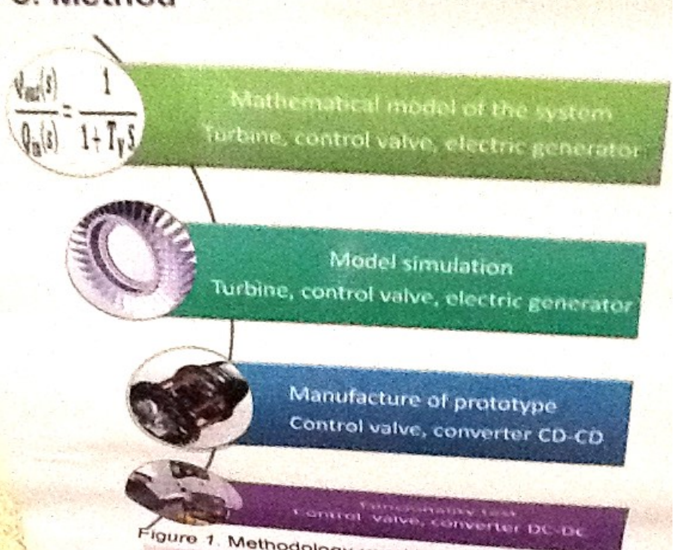

Figure 1. Methodology used in this research

Figure 2. Generator, turbine and control valve

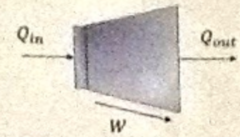

Figure 3. Steam turbine model

$$\frac{Q_{out}(s)}{Q_{in}(s)} = \frac{1}{T_V S+1} \quad \text{Eq. (1)}$$

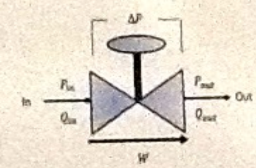

Figure 4. Control valve model

$$G_v(s) = \frac{K_v}{\tau_v s+1} \quad \text{Eq. (2)}$$

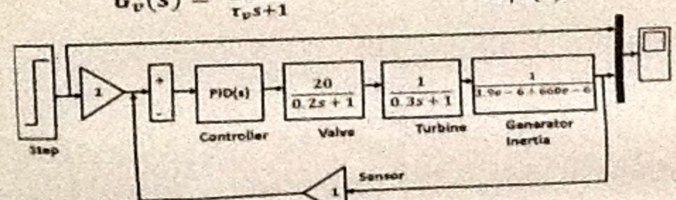

Figure 5. Block diagram Simulink Matlab

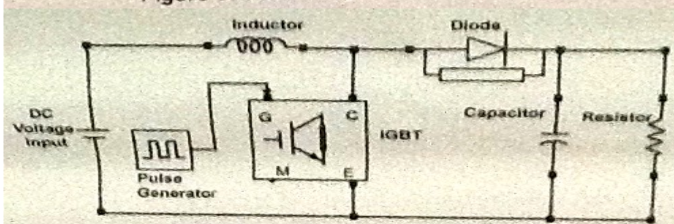

Figure 6. Block diagram Simulink Matlab

$$L\frac{di}{dt} = E - \frac{v}{R}u \quad \text{Eq. (3)}$$

$$C\frac{dv}{dt} = -\frac{v}{R} + iu \quad \text{Eq. (4)}$$

$$e_u = [\,x_1x_2^* - x_2x_1^*\,]\,Y = Y\,(iv^* - vi^*) \quad \text{Eq. (5)}$$

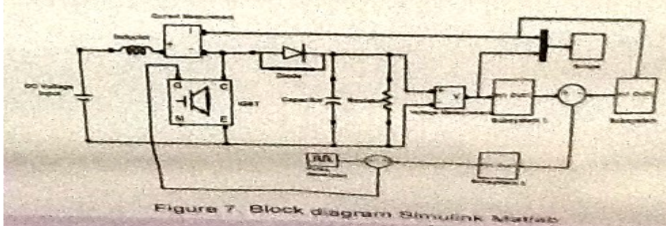

Figure 7. Block diagram Simulink Matlab

4. Results

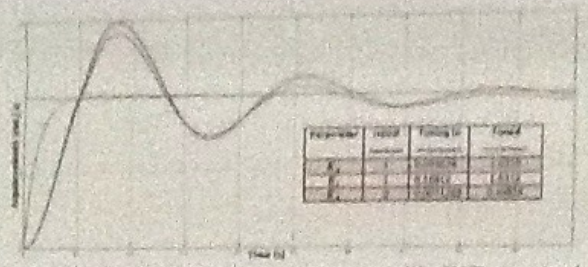

Figure 8. System response with PID control

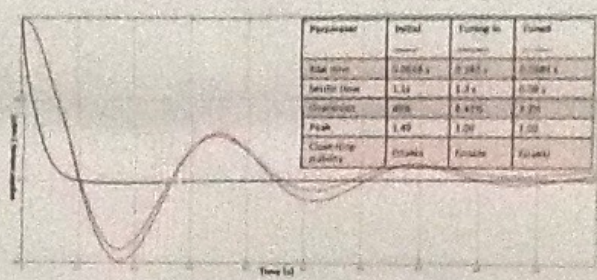

Figure 9. System error signal

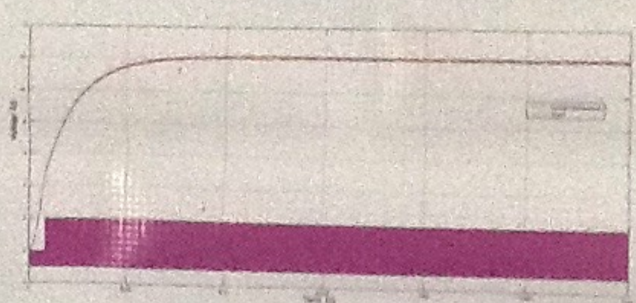

Figure 10. DC-DC Boost response

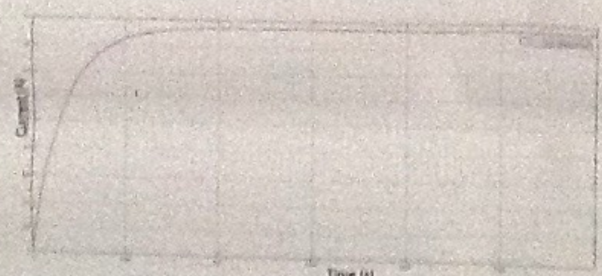

Figure 11. DC-DC Boost Converter Output Current

5. Conclusion

The performance of the integer-degree PID controller converges to the desired value, the error is reduced showing to be stable, its implementation in a programmable controller (PLC) is possible.

The DC-DC pulse converter is able to meet the voltage and current requirements. The DC-DC impulse converter gives a constant 12 V output when changes in the load are experienced by delivering a current of 1.7 A while entering a voltage of 9 V. Demonstrating its implementation in an electronic development board. So far two objectives have been covered, the DC-AC converter is already ready to perform the integration with the two control systems proposed here (75% advance).

Acknowledgements

To CONACYT for the granting of the scholarship No. 597829 to the enginner J. Oscar Vázquez Espinosa and all people who support this project.

6. References

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2016