Model Based Design and Implementation of Engine Speed Governing System for IC Engine Driven Generator Set

Student's Name	**G. B. Mahita Patel**	**RTES (FT-2012)**
Academic Supervisor(s)	Viswanath K. Reddy	
Industrial Supervisor(s)	S. Sreeram, Robert Bosch Engineering and Business Solutions, Bengaluru	

G. B. Mahita Patel

mahita.patel2005@gmail.com
Ph. No: 0 95383 01765

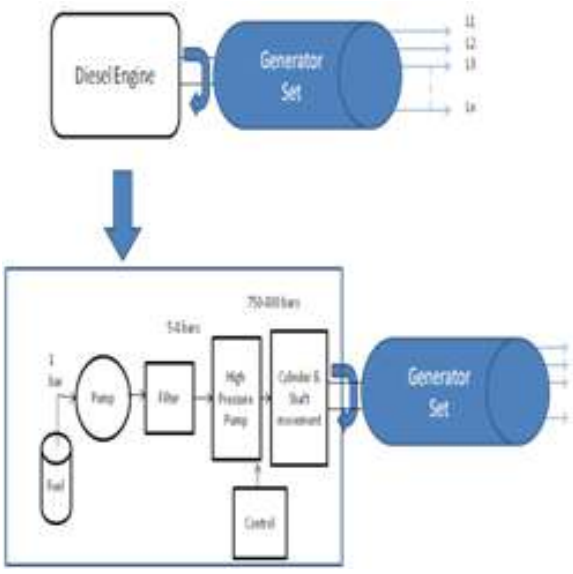
Keywords: Inline Fuel Injection Pump, Diesel Engine, Rack Actuator, Cascade Control

Abstract:

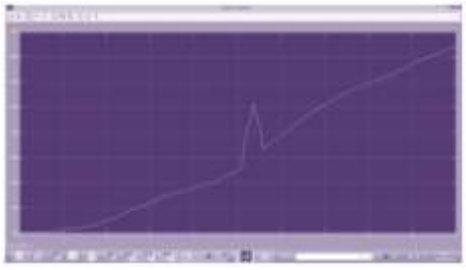
The diesel engine will drive the synchronous generator. The electrical output of generator at nominal voltage (120 V RMS) and frequency (60 Hz) should be regulated despite variation in the electrical loads. If there is variation in load, there will be variation in the engine speed. The engine speed should be maintained at 1500 rpm to maintain this nominal electrical output of generator. Hence the engine speed should be controlled with controlling the fuel injected. In this work, simulation model of engine speed governing system that considers the control of the fuel injected by controlling the movement of the rack in inline fuel injection pump electronically is developed. The challenge to develop this system lies in strictly maintaining a constant engine speed in spite of having undetermined changes in the electrical loads.

Engine speed governing system is designed and modelled in SIMULINK. As an indication of rack movement, as actuator is modeled. For acquiring the Engine behavior for simulation, through the experimentation carried out in actual engine various look up tables were obtained and modeled. The control algorithm for the system is developed using cascade PID controller. The cascade position control of this actuator is developed by taking feedbacks of position, speed and current. By acquiring the position value in degrees will give the corresponding Engine Speed with the help of lookup tables and so the Engine speed is fed back to maintain a constant desired speed of 1500 rpm. The Transient response with performance over ISO 8525 standards is obtained. The model is ported on embedded core to analyze the real time performance by generating the C code from the model designed in SIMULINK.

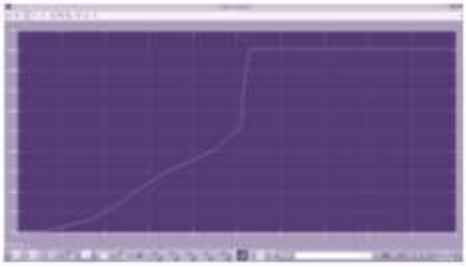
Simulation results of obtaining the best performance of the experimental results are in agreement with the desired specifications and well within the ISO 8525 standards. As per the requirement, actuator positioning rise time is 150 ms with response time 160 ms, then rotation within 0° to 85°, corresponding linear rack movement of 0 to 21 mm. The engine speed settles within 5 seconds with a steady state error of 15 rpm. Suitable mechanisms has to be evolved to test the performance of the over-all system with respect to load variation.



Generator set



Without PID control (open loop system)



With PID control (closed loop system)