

Using Robust Control to Eliminate Instability in Hydraulic Generator Drives

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Introduction

Traditional control of a “hydraulic generator drive” incorporates two separate closed loop controllers: the first controls the output speed of the hydraulic motor / speed of the generator and the second controls the output voltage of the generator. A common problem with this system occurs when these two separate closed loop controls influence each other and cause instability in the whole system.

Author’s Note: For this article, the terms “generator” and “alternator” mean the same thing which is a device that generates an AC electrical output from a rotating input.

Research / Testing / Results

Sauer-Danfoss has developed a new “Robust Control” system using PLUS+1™ for the common hydraulic generator drive (patent pending). This control system uses one common controller for the entire generator system. The system consists of a closed loop generator speed control and an open loop voltage control. This solution eliminates troublesome interactions when controlling speed and voltage simultaneously. This system also eliminates any need for an expensive automatic voltage regulator (AVR) which is normally the closed-loop control for voltage. The new system is more efficient than typical systems that incorporate flow control orifices or charge flow.

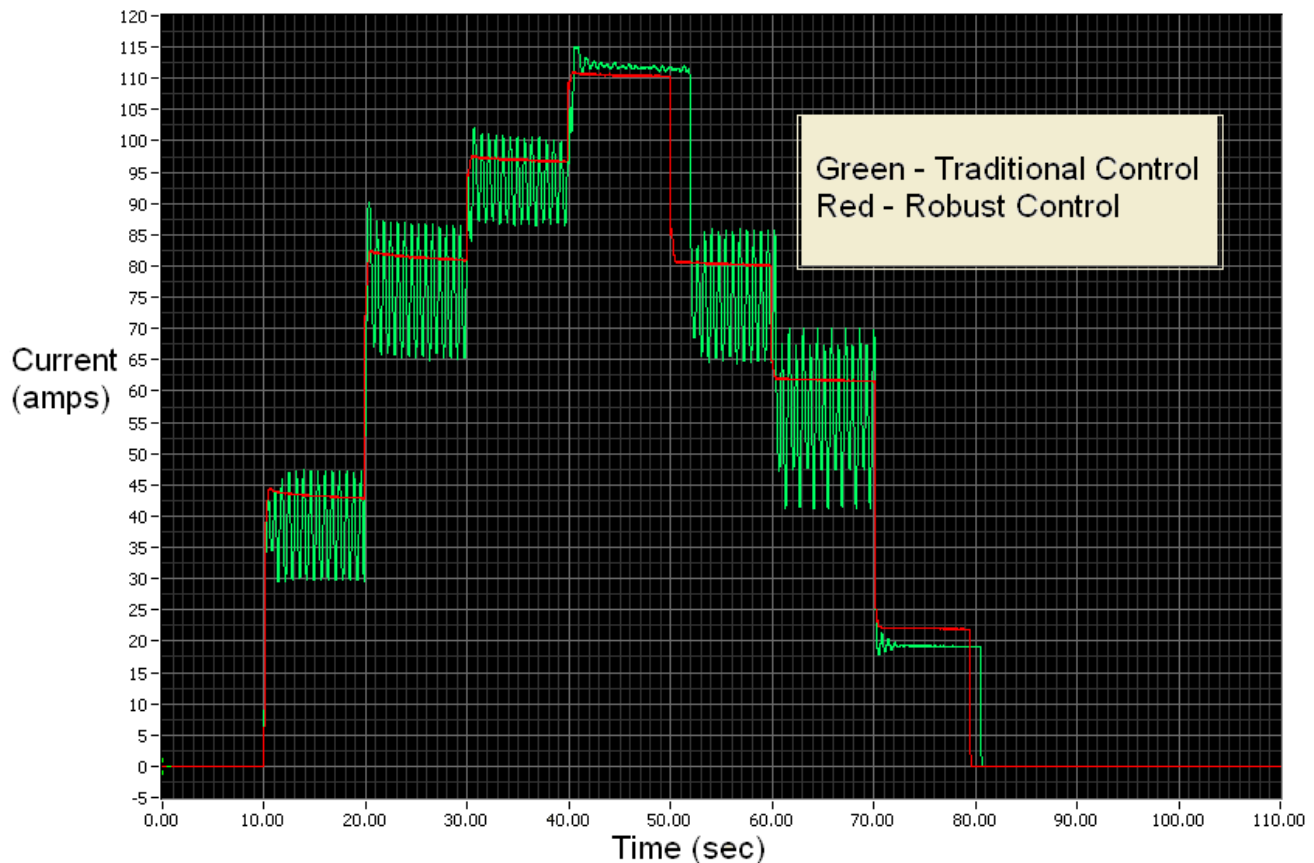


Figure 1. Output current of a generator stepping up the load and then stepping back down.

New features on the system:

- a. Speed and voltage are controlled with one controller which allows control over the entire system.
- b. The open loop voltage control eliminates expensive equipment in the generator. This control works because the controller can calculate how much load is on the generator by monitoring the amount of current that is sent to the pump control.
- c. The new system eliminates the typical flow control valve or the fixed flow control orifice or charge circuit and also eliminates the power consumption of these components.
- d. Using one controller instead of two simplifies the process of set-up, diagnosis, and tuning the system when installed in a machine.

Conclusion

Using PLUS+1 software, an S45 pump and an S40 motor, Sauer-Danfoss has developed a “Robust Control” for the generator drive that eliminates instabilities caused by controlling speed and voltage simultaneously. This control system also eliminates the need for the AVR in the generator and inefficient flow control hardware such as a charge pump or a flow control orifice.