

Questionable Publicity

IEEE *Control Systems Magazine* is not what you would call the popular press. I admit that it's unlikely this publication would sell a lot of copies on a typical newsstand. Nevertheless, it has occurred to me that, with a little creativity, we can make our subject a lot more interesting to the general public. Here's how.

I'll start with the assumption that people want to read about things that are entertaining or affect them in some way. Take disasters, for example, a subject of great popular interest. To help the public appreciate the scope of a disaster, scientists have developed the device of assigning a number to each event. Although earthquakes are scientifically complex, Richter simplifies everything by means of a numerical scale. A 3.0 earthquake would shake the floor slightly, while 7.0 would do serious damage. Likewise, Saffir and Simpson provide a simple rating scale for hurricanes, where Category One means "no real damage to buildings," and Category Five means "complete roof failure" as well as many other unpleasant things.

So here is my proposal for increasing public appreciation for control systems. Actually I have two proposals.

The first proposal is to create a *class rating*. This rating would reflect the level of sophistication and complexity of a control system. Here's how it might go:

- » Class 1 Control System: Basic logic operations, mostly open loop, allows interrupts but otherwise proceeds according to a set plan.
- » Class 2 Control System: At least one single-input, single-output (SISO) feedback loop with real-time sensing and a logically simple algorithm.



Dennis Bernstein visiting the Africa Museum in Tervuren, Belgium.

- » Class 3 Control System: At least one SISO feedback loop, controller dynamics with memory, may include PID antiwindup logic to account for hardware limitations, tuned using minimal modeling information.
- » Class 4 Control System: Multi-input, multi-output (MIMO) feedback loops based on detailed plant modeling information, including nonlinearities and uncertainty.
- » Class 5 Control System: MIMO, fault-tolerant, networked feedback loops with the ability to adapt to unforeseen plant

changes through online identification and reconfiguration.

This system would be a boon to manufacturers. Once customers become familiar with the rating system, it will be commonplace to consider the class as part of the purchasing decision. Would you buy a washing machine rated only Class 1? Upscale consumers would likely be attracted to something at Class 3 or higher. Certainly automobiles, which are much more visible to friends and neighbors than washing machines, would entail even more pressure for class status. It would be de rigueur for a high-end Lexus and Cadillac to have a Class 4 or higher rating—duly noted by an elegant decal. Manufacturers of a wide range of devices would then be forced to incorporate all kinds of new control features to meet demand. And that

would mean a lot more projects for us.

But this is only one side of the coin. There's still the catastrophe aspect that we can exploit. When a control system fails, we need to have a simple device for communicating to the anxious public what went wrong. For that, I propose the following *category system*:

- » Category 1 Control-System Disaster: Control system fails due to malfunctioning hardware.
- » Category 2 Control-System Disaster: Control system fails due to a software bug.
- » Category 3 Control-System Disaster: Control system fails

due to a lack of robustness to unforeseen modes of operation.

- » Category 4 Control-System Disaster: Control system fails due to overwhelming system complexity.
- » Category 5 Control-System Disaster: Control system fails due to unknown effects that confound control system engineers.

Now, whenever a disaster occurs due to the failure of a control system, it will be easy to communicate to the public what went wrong. *Sudden uncontrolled rudder on the 737? Category 1. Ariane 5 destroyed during launch? Category 2. Power grid goes down? Cate-*



Suresh Joshi of NASA Langley Research Center and Dennis Bernstein.

gory 4. With this system, reporters could describe complicated technological failures in a way that would be memorable to the public.

The combination of class and category would publicize what we do, enhance sales, and show the public how critical our technology and skills are. But I'm a little worried that this system of classes and categories could also be a two-edged sword. By connecting these scales together, the public might realize that a high class rating could also precipitate a disaster, leading to a demand for control-free products. And that would be bad for us as professionals—not to mention for sales of this esteemed publication.

Dennis S. Bernstein

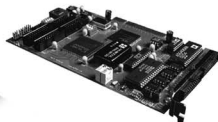


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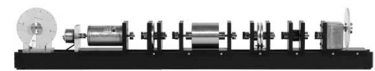
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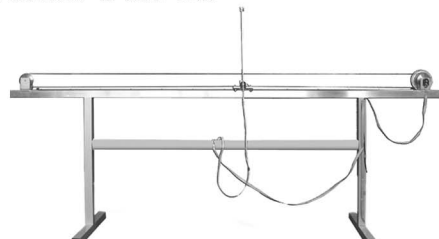
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