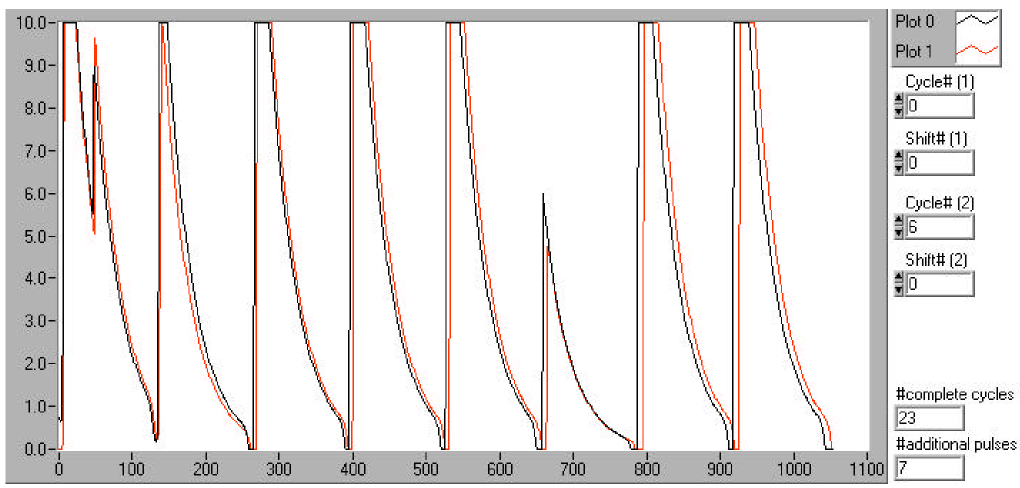
Application Note #616

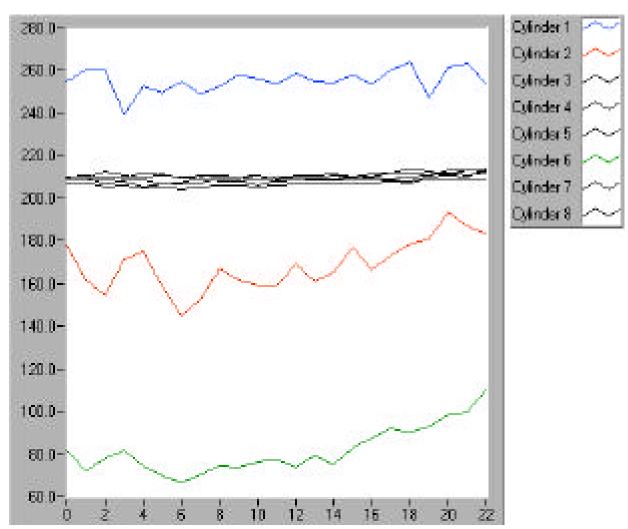
The Problem:
In NASCAR racing there are a number of restrictions to car design intended to maintain a sense of fairness among competing racing teams and a sense of tradition over the years. Accordingly, the maximum engine displacement is limited, the car body must meet certain profile restrictions, and only mechanically controlled, carburetor engines are allowed (i.e. no electronic computers regulating gas flow etc.). The trick is to get more out of a car while staying within these restrictions. To do this a couple of NSCAR racing enthusiast, one a retired engineer and the other the owner of a machine shop, invented a tool to help them get more out of a traditional mechanically controlled engine. What they came up with was a special torque transducer that could be mounted between the engine's crankshaft and its flywheel that allowed them to monitor the torque produced by each cylinder. Because the two of them were funding the development with their own money they were on an extremely tight budget. With this in mind, they built the transducer themselves, along with an engine test stand, and the custom electronics. But, they needed help collecting and analyzing test data.

The Solution:
Within a budget of $900, we advised them to purchase a copy of LabVIEW from National Instruments, along with a suitable plug-in multifunctional I/O card for a PC. When everything was in place, I went to their shop and helped them collect torque measurement data from a half dozen engine runs. To collect the data, I used an unmodified "VI" available within the example's directory of LabVIEW to stream the data directly to disk in binary format.

Back at our office, I wrote several VI's to read back and analyze the data. Data from one of these VI's is shown to the right. It lets the user directly compare the torque pulse from one cylinder to the next, or to compare the torque pulse from the same cylinder from one firing to the next. Data from another VI is shown below. This VI integrates the torque pulse for each cylinder to determine the work done by that cylinder during each of the recorded cylinder firings.



This data demonstrates that torque pulse produced by the 3rd, 4th, 5th, 7th, and 8th cylinders in the firing sequence are nearly identical to one another and from one firing to the next. By contrast the 1st, 2nd, and 6th cylinder in the firing sequence have very irregular torque pulse that vary significantly from all of the other cylinders and even from one firing to the next of the same cylinder. This indicates there may be problems with the quantity and mixture of air and fuel being delivered to these cylinders that could be rectified with a better intake manifold.



November, 99