Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Advantages of synchronized lock-in amplifiers in experiments ANDREAS RYDH, Stockholm University — The lock-in amplifier is a versatile instrument in many disciplines of physics, due to its ability to resolve small AC signals of given frequency and phase with high resolution. A modern, digital lock-in amplifier digitizes the signal before demodulation and further processing and is thus little more than a data acquisition unit (ADC) and a computer. With the availability of powerful signal processors such as DSPs and field-programmable gate arrays (FPGAs), the potential of the lock-in technique has broadened. Several frequency components of a signal could for instance be studied simultaneously. Combining several ADCs in one instrument rather than having separate lock-in amplifiers is especially advantageous. We have developed such a lock-in amplifier with eight simultaneous-sampling inputs connected to an FPGA. With synchronized channels, the time resolution is increased, making it possible to study time-dependent signals and their correlation. This makes the signal source stability less critical and further improves the signal to noise ratio. Examples of experimental use include transport measurements, low-temperature thermometry and frequency characterization.

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Date submitted: 20 Nov 2009 Electronic form version 1.4