# ACOUSTICS2008/3120
# Active control of a vibrating string

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We discuss the specifics of applying active feedback control to a vibrating string. Using sensors, actuators, and digital controller hardware, we make the acoustics of the string programmable, yet the string retains its tangible qualities. As a consequence, fretting, bowing, and plucking controlled and uncontrolled strings have similar physical consequences. Consider that any controller emulating a network of springs, masses, and dashpots attached to the string is a passive controller. To allow the string's acoustics to be programmable over a wide range, we should be able to implement passive controllers. This means that there must be at least one linear and collocated sensor/actuator pair. We explain how to construct such a pair in the laboratory. Finally, we explain one controller particular to one-dimensional systems such as vibrating strings. Whenever the sensor detects a pulse arriving, the actuator emits a new pulse. The output spectrum consists of a harmonic series proportional to the sampling of the product of the pulse's Fourier transform and the transfer function from the actuator to the sound recording device. Sound examples are presented. Finally, we discuss an open source environment we have created for adjusting controller parameters in real time from standard computer music software.