Multi-Bunch Longitudinal Dynamics and Diagnostics via a Digital Feedback System at PEP-II, DAFNE, ALS and SPEAR*, J. FOX, H. HINDI, R. LARSEN, S. PRABHAKAR, D. TEYTELMAN, A. YOUNG, SLAC; A. DRAGO, M. SERIO, INFN-LNF; G. STOVER, LBNL - A bunch-by-bunch longitudinal feedback system based on a programmable DSP architecture is used to study coupled-bunch motion and its sources. Experimental results are presented from PEP-II, DAFNE, ALS and SPEAR to highlight the operational experience from 4 installations, plus show novel accelerator diagnostics possible with the processing system. Modal growth and damping rates are measured via short (20 ms) transient excitations for unstable and stable coupled-bunch modes. Data from steady-state measurements are used to identify unstable modes, noise-driven beam motion and noise sources. A novel impedance measurement technique is presented which reveals the longitudinal impedance as a function of frequency. This technique uses the feedback processing to measure the synchronous phase and charge of every bucket, and the transfer function from fill shape to synchronous phase yields the impedance seen by the beam at revolution harmonics.

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