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Chaos Without Nonlinear Dynamics JONATHAN BLAKELY, NED CORRON, SCOTT HAYES, SHAWN PETHEL, U.S. Army RDECOM — Chaos is usually attributed only to nonlinear systems. Yet it was recently shown that chaotic waveforms resembling those of the famous Lorenz system can be synthesized by linear convolution of a basis function with a random information signal. The basis function contains a growing oscillation that ends in a large pulse. We show that this function is easily realized when viewed backward in time as a pulse followed by ringing decay. Consequently, a linear filter driven by random pulses outputs a waveform that, when viewed backward in time, exhibits essential qualities of chaos, i.e. determinism and sensitive dependence on initial conditions. This phenomenon suggests that chaos may be connected to physical theories whose framework is not that of a deterministic nonlinear dynamical system.

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