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Self Generation of Chaos From Electrical Solitons OZGUR YILDIRIM, DONHEE HAM, Harvard University — The nonlinear transmission line (NLTL) is a structure that can generate electrical solitons of subpicosecond duration. As an autonomous soliton generator utilizing the NLTL, thus far, only periodic electrical soliton oscillators have been reported. These circuits self generate a periodic train of solitons, where an amplifier with a saturable absorber prevents the generation of multiple solitons and hence their nonlinear collisions. However, if the amplifier encourages the generation of multiple solitons and their collisions, the system can attain chaos, because the position of the soliton modulates after each collision, disrupting the periodicity. In this work, for the first time, we experimentally demonstrate such a chaotic system. Our circuit self generates an aperiodic signal, which has a continuous spectral distribution. We confirm its chaotic behavior by calculating the largest Lyapunov exponent, and show that the dimensionality of the generated chaos is high (d>3) by performing a false-nearest-neighbors analysis. Moreover, we explicitly measure the route from periodic soliton oscillation to chaotic oscillation via decreasing the time constant of the saturable absorber, showing the effect of soliton collisions on period-doubling bifurcations and finally the creation of chaos.

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