Abstract Submitted
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A model for shock wave chaos[1] LUIZ FARIA, ASLAN KASIMOV, KAUST, RODOLFO ROSALES, MIT — We propose the following simple model equation that describes chaotic shock waves:

$$u_t + \frac{1}{2}\left(u^2 - uu_s\right)_x = f\left(x, u_s\right).$$

It is given on the half-line $x < 0$ and the shock is located at $x = 0$ for any $t \geq 0$. Here $u_s\left(t\right)$ is the shock state and f is a given source term [1]. The equation is a modification of the Burgers equation that includes non-locality via the presence of the shock-state value of the solution in the equation itself. The model predicts steady-state solutions, their instability through a Hopf bifurcation, and a sequence of period-doubling bifurcations leading to chaos. This dynamics is similar to that observed in the one-dimensional reactive Euler equations that describe detonations. We present nonlinear numerical simulations as well as a complete linear stability theory for the equation.

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