1-D Burger's equation

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1 Non-linear Burger's equation with linear estimator

$$
\begin{aligned}
\frac{\partial w}{\partial t} + w\frac{\partial w}{\partial x} &= \mu\frac{\partial^2 w}{\partial x^2} \\
w(0,t) &= u_s + u(t) \\
\frac{\partial w}{\partial x}(1,t) &= g_s \\
w(x,0) &= w_s(x) + w'(x)
\end{aligned}
$$

The linear estimator is

$$
\begin{aligned}
\frac{\partial z_e}{\partial t} + w_s\frac{\partial z_e}{\partial x} + z_e\frac{\mathrm{d}w_s}{\mathrm{d}x} &= \mu\frac{\partial^2 z_e}{\partial x^2} + L(y_o - Hz_e) \\
z_e(0,t) &= u(t) \\
\frac{\partial z_e}{\partial x}(1,t) &= 0 \\
z_e(x,0) &= 0
\end{aligned}
$$

The feedback control is given by

$$u(t) = -Kz_e(t)$$

and the observation is

$$y_o(t) = H(w(t) - w_s) = w(1,t) - w_s(1)$$