Disclaimer 1 about D-Feedback: Lack of Causality

Consider some state-space models:

$$\dot{x} = Ax + Bu \qquad sX = AX + BU \qquad (s - A)X = BU$$
$$y = Cx \qquad Y = CX \qquad \frac{Y}{U} = \frac{CB}{s - A} \equiv \frac{q(s)}{p(s)}$$

$\deg(q) < \deg(p)$ — strictly proper transfer function

$$\dot{x} = Ax + Bu \qquad sX = AX + BU \qquad (s - A)X = BU$$
$$y = Cx + Du \qquad Y = CX + DU \qquad Y = \frac{CB}{s - A}U + DU$$
$$= \frac{CB + D(s - A)}{s - A}U \equiv \frac{q(s)}{p(s)}$$

$\deg(q) = \deg(p)$ — proper transfer function

Causal systems have proper transfer functions.