

# String Stability for Hysteretic Flows

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## Abstract

We investigate string stability in continuum flow models where information propagates to the left. String stability concerns whether oscillations decay or grow as they travel, with rates measured in the spatial variable. In traffic flow, this corresponds to how speed oscillations of successive vehicles evolve as disturbances move upstream.

Positive hysteresis loops may amplify flux oscillations and can generate shocks. For hysteretic LWR model, a solution containing a large enough hysteresis loop in the positive hysteresis region will develop stop-and-go waves, else the flux oscillations will decay as they propagate upstream. A necessary and sufficient condition for this "large enough" is found. In the region of negative hysteresis, hysteresis loops damp flux oscillations. For this case, we formally derive spatial decay rates for time-periodic string-stability solutions for several hysteretic models such as hysteretic LWR model, hysteretic ARZ model, transport with absorption and desorption model. Similar decay rates is also obtained for spatially periodic solutions of Amadori-Bressan-Shen hysteretic flow model.