With zero initial states, the first pair gives $Y_1/X = 0.3/(1 + 0.5q)$, the second gives the stated biquad, and summation gives H. There are three dynamic states; γ_0 remains the source's free direct-feedthrough parameter.

Structural or analytic derivation

This is the decomposition of the rational operator into pole blocks. The first pole is -0.5 and the conjugate pair has modulus $\sqrt{0.43} < 1$, so each causal branch is stable and their finite sum is stable for finite γ_0. The result follows from the quadratic root product and negative discriminant, with no long simulation.

Comparative cost and preferred method

Parallel branches can be evaluated independently; total arithmetic remains constant per sample and order three. The source already supplies partial fractions, so recombining into a cubic and refactoring would add setup with no benefit. Parallelism is a scheduling option, not an asserted reduction in total arithmetic.