

Lecture 12: Perfect Reconstruction

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Self Evaluation Quizzes

Q 1. Consider equation 6 from lecture script, why is the delay needed? Can you intuitively justify it?

Ans. Ideally, we want a perfect reconstruction system but we can not achieve it because of finite processing time delays. So the best we can do is to achieve a system which just gives output as a delayed copy of input with no other changes. Also, the delay factor takes care of causality of the system.

Q 2. What is the effect of cascading a $(1 - z^{-1})$ term in the high pass analysis filter?

Ans. By cascading $(1 - z^{-1})$ term we are putting more and more zeros at high frequency (π). This makes high pass filter sharper and closer to ideal. In other words we are retaining smooth terms on the low pass side.

Q 3. Interpret the following equation in the wake of perfect reconstruction:

$$\tau_0(Z) = \frac{1}{2} \{ H_1(-Z)H_0(Z) + (-H_0(-Z))H_1(Z) \} \quad (1)$$

Ans. As $H_1(Z)$ is a high pass filter (in synthesis side), then $H_1(-Z)$ becomes a low pass filter. So the first term is a low pass term. Similarly, $H_0(Z)$ is a low pass filter (in synthesis side), then $H_1(-Z)$ becomes a high pass filter. So the second term is a high pass term. We can interpret the equation easily. The first term retains low pass content and the second term compliments it as high pass filter. If the filters are matched properly so that whatever is discarded by low pass filter is taken up by high pass filter and vice versa.