Introduction to Time – Varying Electrical Networks
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Lecture No. 77
Noise in LPTV networks with sampled outputs

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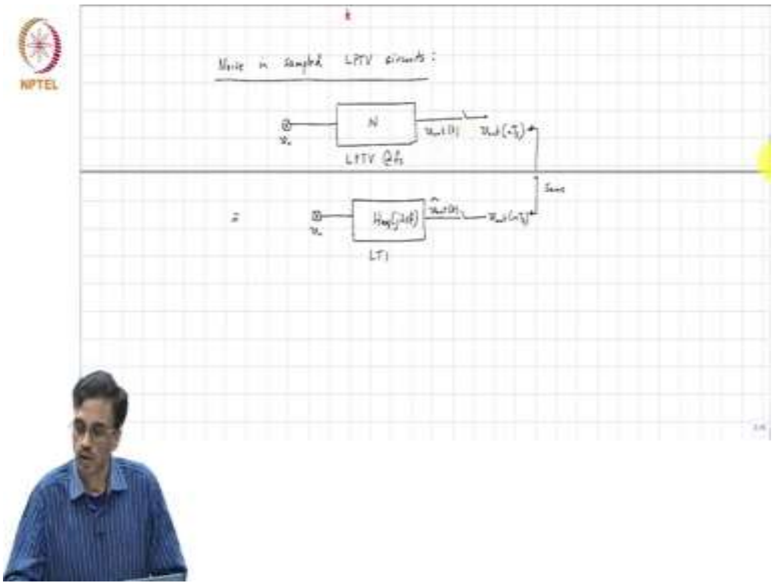

Now, remember that, in practice a lot of these networks that we use, especially in mixed signal is where we are not really interested in the entire output waveform, we are only interested in the sampled value of the waveform and that sample there is a rate at which the output is sampled is the same as that at which the system is varying.

So, noise in sampled LPTV system circuits I would say. And this, the idea is the following Well, we have an input which is Vn and then this is a network n which is LPTV at fs and this is vout and we are interested in the statistical properties of or vout of and n times ts. Most of the time and interested only in the mean square value or the noise. Well, this is as you can imagine much easier to handle. Because as we have already seen this is equivalent to taking Vn passing it through an LTI system.

Student: H equivalent of.

Professor: H equivalent of j 2 pi f, this is LTI. And this is v out of nTs. The sequence here and the sequence here are the same, but the waveform here is not necessarily v out hat is not necessarily the same as v out, but the sequence is and the sample sequences are.

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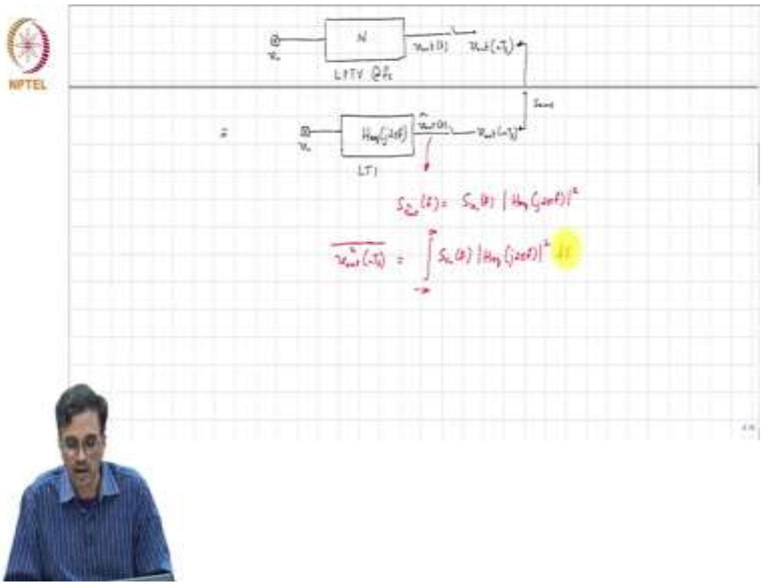

So, well this is this is easy. What comment can we make about the noise spectral density there?

Student: H equivalent of.

Professor: Very good. This we already know because the noise spectral density there S v out hat of f is nothing but s Vn of f times mod h equivalent of j 2 pi f a whole square. Correct. So, what comment can we make about? And because, if Vn is stationary, then we out hat to t the noise at the output is also going to be stationary, which basically means that its mean square value does not change with time. So, at whatever time you sample it, the mean square value remains the same. So, the mean square value of the samples is simply. How do we how do you think we can do this?

This is the spectral density of the waveform at the output. So, if you want to find the means, the mean square value you integrate this from minus infinity to infinity or 0 to infinity depending on if you are working with single-sided or double-sided spectrum. So, S Vn of f minus h equals the end of j 2 pi f whole square df. And this is independent of n simply because the process of the output of the time invariant filter is stationary. So, again if you know h equivalent of j 2 pi f then this calculation becomes straightforward.

Now if you have multiple noise sources, what will you do? Well yeah I mean, you find an equal and time invariant transfer function from each noise source to the output, and then repeat this calculation