Connection: between Ng notes and Spectral PhL 3.22.13

A. In Spectral we deal with

$$\langle a_m a_n \rangle \equiv (1/I) \sum_{i=1}^{I} a^i_m a^i_n$$

where m and n mark positions in time. so a_m is a digital thing. You could write

$$\langle a(t_m) a(t_n) \rangle = (1/I) \sum_{i=1}^{I} a^i(t_m) a^i(t_n)$$

I know that if random variables x_a and x_b each have zero mean, we can say

$$\Sigma_{ab} \equiv \mathrm{cov}(X_a, X_b) = (1/m) \Sigma_{i=1}^{m} (x^{(i)}_a - \mu_{Xa}) (x^{(i)}_b - \mu_{Xb}) .$$

$$\mathrm{cov}(X_a, X_b) = (1/m) \Sigma_{i=1}^{m} x_a^{(i)} x_b^{(i)}$$

$$\mathrm{cov}(X_m, X_n) = (1/M) \Sigma_{i=1}^{m} x_m^{(i)} x_n^{(i)}$$

$$\mathrm{cov}(A_m, A_n) = (1/M) \Sigma_{i=1}^{m} a_m^{(i)} a_n^{(i)}$$

and this looks a lot like $\langle a_m a_n \rangle$. If they don't have zero mean, I think you can still say

$$\mathrm{corr}(A_m, A_n) = (1/M) \Sigma_{i=1}^{m} a_m^{(i)} a_n^{(i)}$$

So A_m is the random variable associated with the value of the pulse at position m in the pulse train. The index i is the statistical sum index.

B. Now what about autocorrelation.

$$r_x(t) \equiv \int_{-\infty}^{\infty} dt' \, x(t') \, x(t' + t) \qquad (32.1)$$