Laplace ...

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(a functional transformation, function $->$ function)
(a complex, more specifically, analytic function)
(a generating function, analog with $\int dt$ in place of $\sum$)
(approximation relations with discrete generating functions, aka "z-transform". Digital signal processing implements or is approximately related to analog signal processing.)

(When we relate a continuous to discrete transform, try to relate that to

- The discrete function gives approx. samples of the continuous.
- The analytical properties of the transform affect the form (growth rate) of the functions.

l)

(a formal ratio of an extensor's Plucker coordinates)
(eigenvalue of eigenvector e^{st} under a differential operator eg $(a\frac{d}{dx}^2 + b\frac{d}{dx} + c)(e^{st}) = (as^2 + bs + c)e^{st}$
(formal expression for impedances R, $1/Cs$, Ls)
(linear differential operator $s(f) = \frac{d}{dx}f$)
(deletion/contraction, "capacitor shorts out on high s, inductor opens on low s" [6])
(characterization of "responses" defined among port variables)
(?? Indicator of a step respone)
(asymptotic expansions as $s \to \infty$ and $s \to 0$)

More and more

(asymptotic behavior of a generating function's coefficients, which are the generated function's values, determined by analytic properties of the generated function. Relate EE, circuits and signals literature to statistical mechanics and combinatorics. [2, 3, 5])

in [5]: p.287 (Perspective of Ch. IV): analytics: assign values to the generating function's variable. "Singularities and growth. ... signularities provide essential information on the growth rate of a function's coefficients. ... "First Principle" relates exponential growth to the location of sinularities."

within $[z^n]F(z) = A^n\Theta(n)$:

- First Principle: Location determines A^n (exponential growth).

- Second Principle: Nature determines the associate subexponential factor $\Theta(n)$.

must relate THIS to all the EE Laplace transform, Bode diagram, etc stuff.

(random generation: [4])

(geometry of phase shifts)

(risetime related to basic topology, graph theory, topology of lumped networks expressed by oriented matroids)

(FUTURE hopefully not too much: Complex oriented matroids of Anderson, et. al. [1])

Fourier series as (1) elements of a group algebra, so group algebra product is Fourier series convolution; (2) linear combination of group characters, which are mutually orthogonal.

References

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[3] Young-Bin Choe, James G. Oxley, Alan D. Sokal, and David G. Wagner. Homogeneous multivariate polynomials with the half-plane property. *Adv. Appl. Math.*, 32:88–187, 2004.

[4] Philippe Duchon, Philippe Flajolet, Guy Louchard, and Gilles Schaeffer. Boltzmann samplers for the random generation of combinatorial structures. *Combinatorics, Probability and Computing*, (13):577–625, 2004.

[5] Philippe Flajolet and Robert Sedgewick. *Analytic Combinatorics*. Cambridge University Press, 2009.

[6] Marc Thompson. *Intuitive Analog Circuit Design*. Newnes/Elsevier, 2nd edition, 2014.