Computerized Tomography Noise Reduction and Minimization by Optimized Exponential Cyclic Sequences (OECS)

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Abstract:
In general, a theoretical Computerized Tomography (CT) problem can be formulated as a system of linear equations. The discrete inverse problem of reconstructing finite subsets of the n-dimensional integer lattice $\mathbb{Z}^n$ that are only accessible via their line sums (discrete x-rays), in a finite set of lattice directions, results into an even more ill-posed problem, from noisy data. Because of background noise in the data, the reconstruction process is more difficult since the system of equations becomes inconsistent easily. Unfortunately, with every different kind of CT, as with many contemporay advanced instrumentation systems, one is always faced with an additional experimental data noise reduction problem. In the past five decades, trend in Systems Theory, in specialized research area, has shifted from classic single domain information channel transfer function approach (Shannon's noisy channel) into the more structured ODR Functional Sub-domain Transfer Function Approach (Observation, Description and Representation), according to CICT Infocentric Worldview model (theoretically, virtually noise-free data). As a matter of fact, traditional rational number system $\boldsymbol{Q}$ properties allow to generate an irreducible co-domain for every computational operative domain used. Then, computational information usually lost by using classic computational approach only, based on the traditional noise-affected data model stochastic representation (with high-level perturbation computational model under either additive or multiplicative perturbation hypothesis), can be captured and fully recovered to arbitrary precision, by a corresponding complementary co-domain, step-by-step. Then, co-domain information can be used to correct any computed result, achieving computational information conservation, according to CICT approach. CICT can supply us with co-domain Optimized Exponential Cyclic numeric Sequences (OECS) perfectly tuned to their low-level multiplicative noise source generators, related to experimental high-level overall perturbation. Numeric examples are presented.