Distance and Unierror Power Theories in Universal Problem Solving Science

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The least square method (LSM) [1] by Legendre and Gauss is practically the unique known one applicable to contradictory (e.g. overdetermined) problems in data processing. Universal mathematics [2-5] has discovered many principal LSM defects. Distance power theories (DPT) (with any power exponent $t > 1$) use coordinate system rotation invariance via data centralization and standardization, e.g. by a finite overdetermined quantiset [2-5] of n ($n > m$; $m , n \in N^+ = \{1, 2, ...\}$) linear equations

$$_{q(j)}(\Sigma_{i=1}^{m} a'_{ij}x_i + c'_j = 0)\ (j = 1, 2, ... , n)\ (L'_j) \text{ to } _{q(j)}(\Sigma_{i=1}^{m} a_{ij}x_i + c_j = 0)\ (L_j)$$

with their own positive number quantities $q(i)$, m pure number unknown variables x'_i ($i = 1, 2, ... , m$), and any given real numbers a'_{ij} and c'_j in the m-dimensional "space" via dividing (L'_j) by $(\Sigma_{i=1}^{m} a'^{2}_{ij})^{1/2}$. The distance between the jth m-1-dimensional "plane" and point $(x_1 , x_2 , ... , x_m)$ is $d_j = |\Sigma_{i=1}^{m} a'_{ij}x_i + c'_j|/(\Sigma_{i=1}^{m} a'^{2}_{ij})^{1/2}$. Then minimize $^tS(x_1 , x_2 , ... , x_m) = \Sigma_{j=1}^{n} q(j)|e_j|^t = \Sigma_{j=1}^{n} q(j)\ |\Sigma_{i=1}^{m} a_{ij}x_i + c_j|^t$ via intelligent iteration.

Linear (LEPT) and square (SEPT) unierror power theories are also based on intelligent iteration, as well as on linear and square unierrors [2-5] of (L_j)

$$^1E_j=|\Sigma_{k=1}^{m}a'_{kj}x_k-c'_j|/(\Sigma_{k=1}^{m}|a'_{kj}x_k|+|c'_j|)^2,\ ^2E_j=|\Sigma_{k=1}^{m}a'_{kj}x_k-c'_j|/[(m+1)(\Sigma_{k=1}^{m} a'^{2}_{kj}x_k^2 + c'^{2}_j)]^{1/2}.$$

To solve equation set $29x + 21y = 50$, $50x - 17y = 33$, $x+2y = 7$, $2x-3y = 0$ (Figs. 1, 2), compare applying unierror biquadrat theories (EBQT), distance biquadrat theory (DBQT), biquadrat theory (BQT), unierror quadrat theories (EQT), distance quadrat

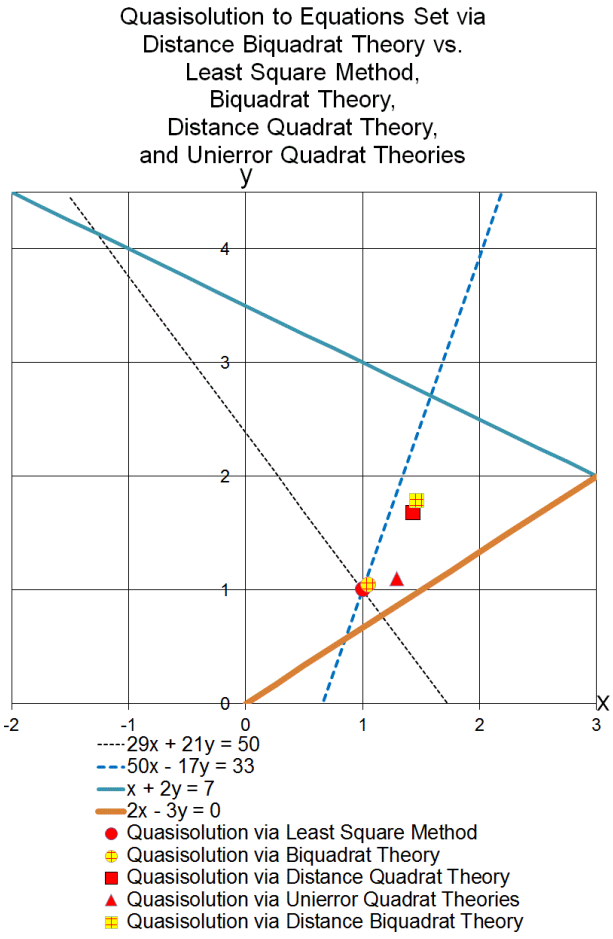

Figure 1. Distance power theories (DPT)

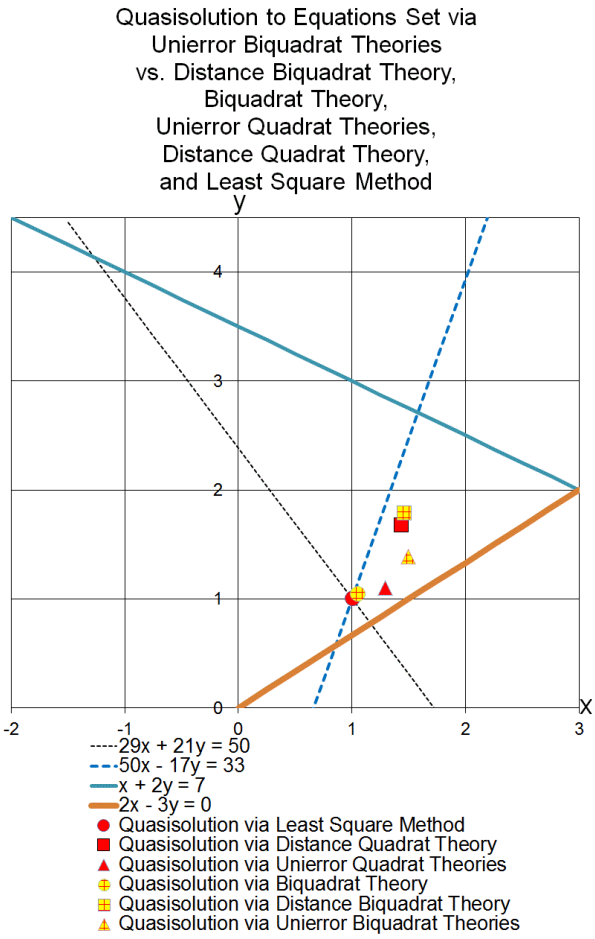

Figure 2. Unierror power theories

theory (DQT) [2-5], and the least square method (LSM) [1]. The LSM ignores the last two equations with smaller factors (unlike EBQT, DBQT, BQT, EQT, and DQT). Both linear (LEQT) and square (SEQT) unierror quadrat theories give very near results, and we have shown the results obtained via linear unierror quadrat theory only. Increasing the power from 2 to 4 provides very substantially improving sensitivity.
Distance power theories (DPT), as well as linear (LEPT) and square (SEPT) unierror power theories providing simple explicit quasisolutions to contradictory problems are very efficient in solving many urgent problems, e.g. in aeronautical fatigue.

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