An Improved Algorithm for Q-scale Analysis in Jitter Decomposition

- OBJECTIVE

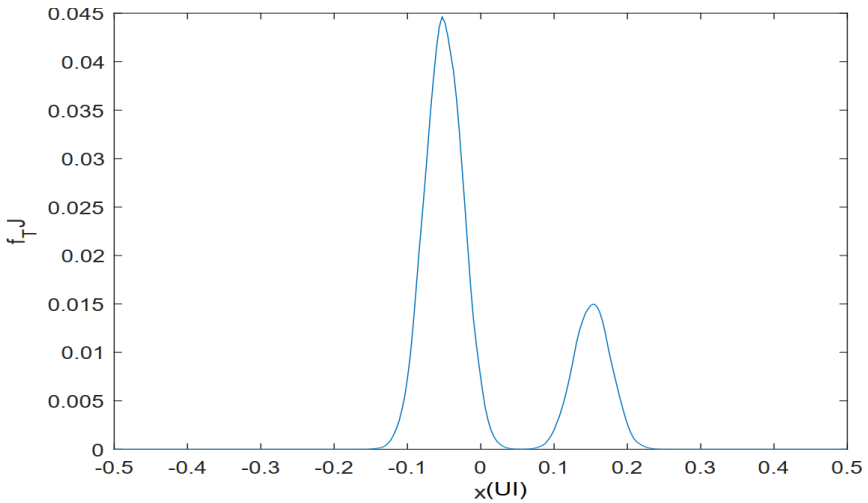

Figure 1. A general example of the probability density function (PDF) of total jitter (TJ) when the probability of the left branch (ρ_L) of deterministic jitter (DJ) equals to 0.75.

$$f_{TJ}(x) = f_{RJ}(x) * f_{DJ}(x)$$
$$= \frac{\rho_L}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu_L)^2}{2\sigma^2}} + \frac{1-\rho_L}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu_R)^2}{2\sigma^2}}.$$

The PDF of TJ can be obtained by convolving DJ with RJ.

$$Q = \frac{x-\mu}{\sigma}$$

The parameters μ and σ, which denote DJ and RJ respectively are the target of jitter decomposition. But the ρ_L is unknown.

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- METHODS

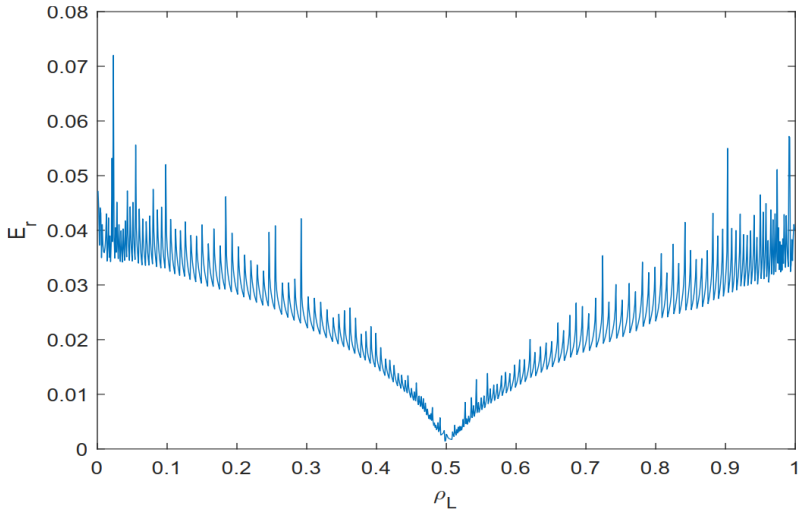

Figure 2. E_r curve when actual $\rho_L = 0.5$.

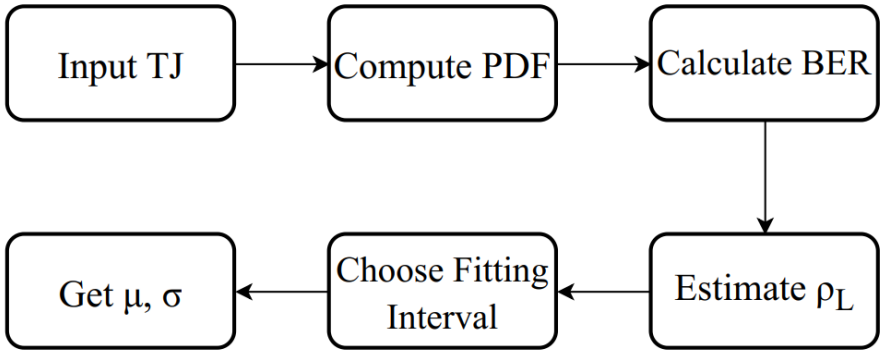

Figure 3. Process diagram of jitter decomposition.

- RESULT

TABLE I
COMPARISON OF ERROR BEFORE AND AFTER IMPROVEMENT.

ρ_L	Tail Interval	μ		σ	
		Before	After	Before	After
0.25	20%	16.4%	1.33%	-12.6%	0.68%
0.50	20%	11.9%	3.13%	-6.99%	-0.51%
0.75	20%	2.88%	2.30%	-3.82%	-1.26%

- INNOVATION
- Estimate ρ_L
- Dynamic fitting interval