

SJTP: Pattern Characteristics

6/18/2001

Disparity Probability

- N-bit sequence
 - # of ones = X
 - # of zeros = $N - X$
- ΔRD = disparity of the sequence
- $p(X, N)$ = probability that X ones occur in N “trials”
 - Assume ones & zeros are equally likely

$$p(X, N) = \binom{N}{X} \left(\frac{1}{2}\right)^N \quad \text{where} \quad \binom{N}{X} = \frac{N!}{X!(N-X)!}$$

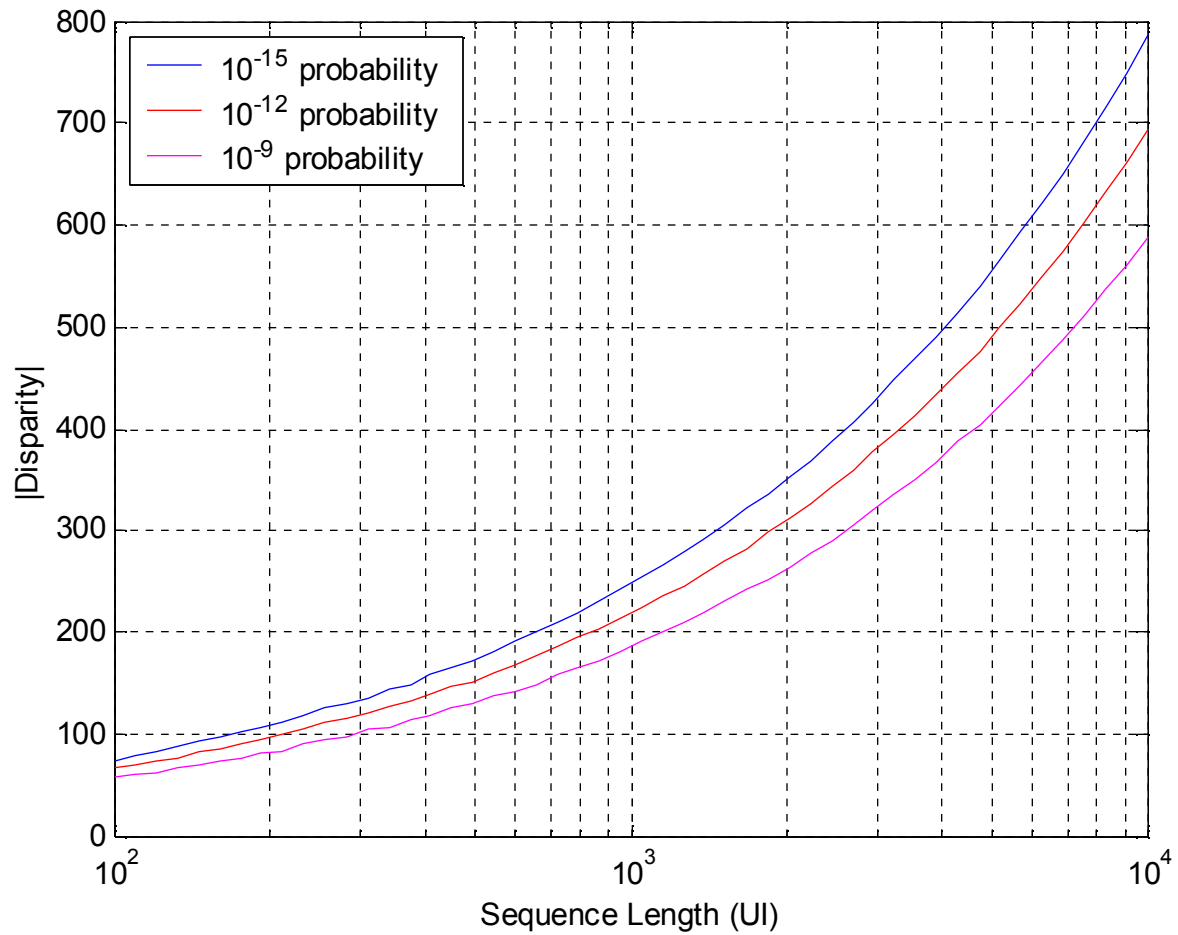
- Probability that $\leq X$ ones occur in the sequence

$$\Pr\{\# \text{ of ones} \leq X \mid N\} = \sum_{i=1}^X p(i, N)$$

- Probability that magnitude of the disparity is $> RD_0$

$$\Pr\{|\Delta RD| > RD_0 \mid N\} = 2 \sum_{i=1}^{(RD_0+N)/2} p(i, N)$$

Disparity Probability



Transition Density Probability

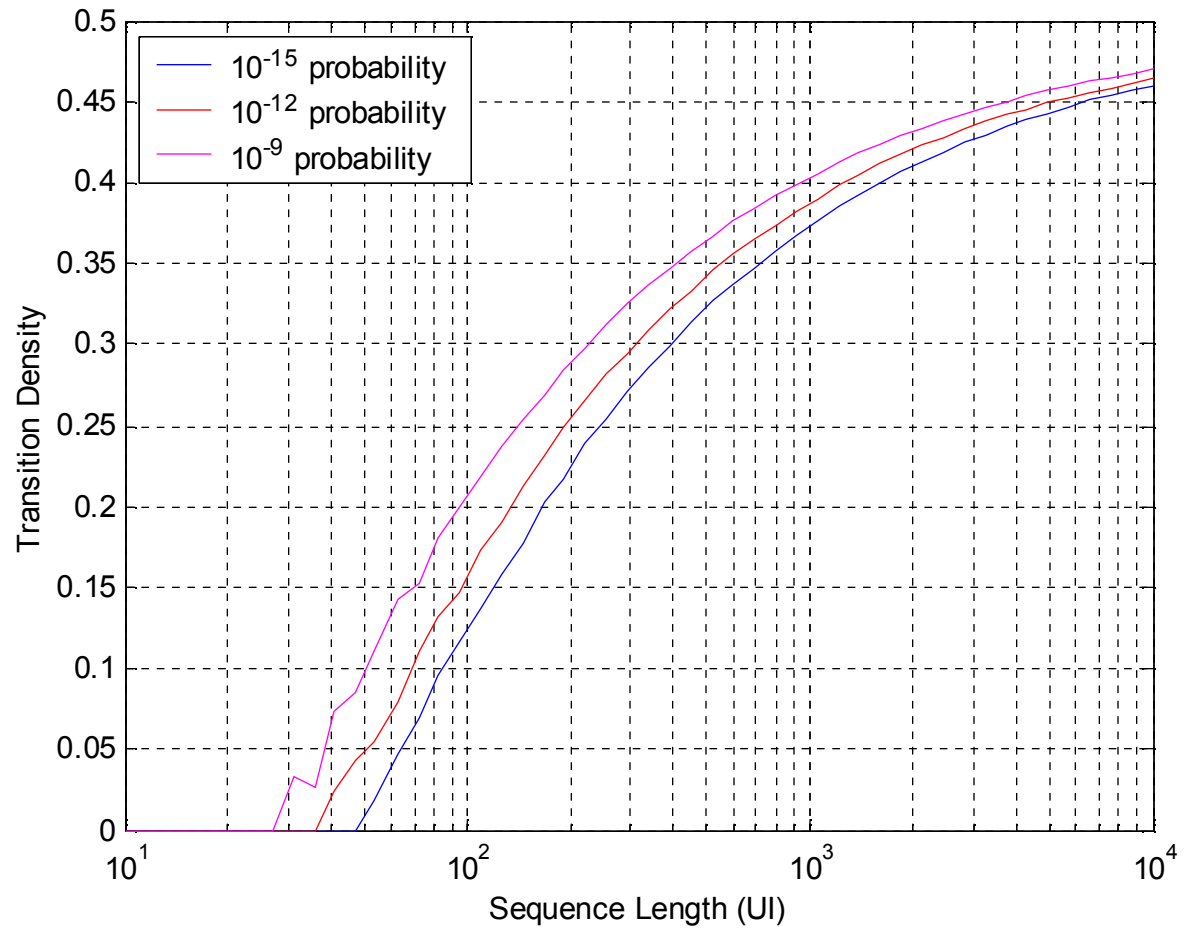
- N-bit sequence
 - X transitions within sequence
- Transition density = X/N
- $p(X,N)$ = probability that X transitions occur in N “trials”
 - Assume ones & zeros are equally likely

$$\Pr\{X | N\} = \binom{N-1}{X} \left(\frac{1}{2}\right)^{N-1} = p(X, N-1)$$

- Probability that transition density $\leq TD_0$

$$\Pr\{X \leq TD_0 N | N\} = \sum_{i=1}^{TD_0 N} p(i, N-1)$$

Transition Density Probability



Pattern Selection Criteria?

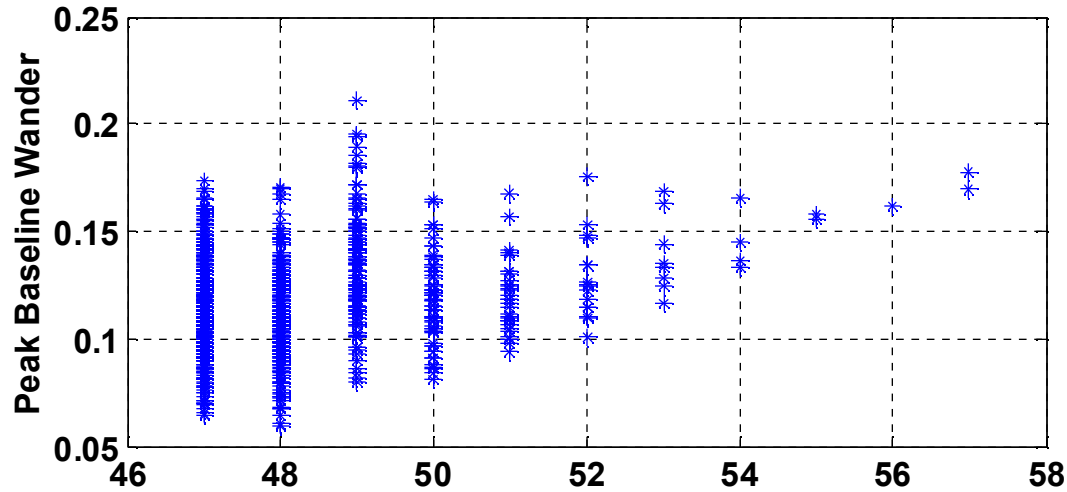
- Looking for events that occur “once per day”
 - Probability $\sim 1 \times 10^{-15}$
- Need to choose sequence length (N)
- Following examples:
 - Transition density calculations
 - $N = 1000 \rightarrow$ transition density ~ 0.37 at 10^{-15} probability
 - Baseline wander calculations
 - Pole corner frequency = $f_c = B/5000$ ($\sim 2.5\%$ RMS wander)
 - 10^{-15} probability $\rightarrow \sim 8\sigma = 0.2$ peak baseline wander

Pattern Characteristics

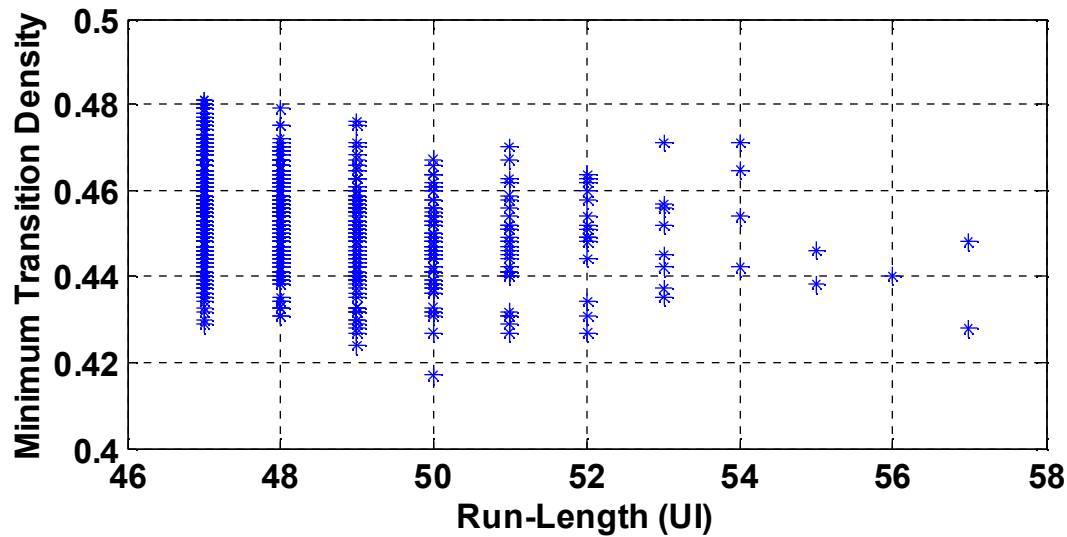
- Procedure
 - Seed PRBS generator with max run-length
 - adjust so max RL occurs in the middle of the sequence
 - Generate 128 block PRBS
 - Compute statistics
- Parameters
 - Max runs of ones or zeros
 - Data is all zeros or LF
 - Search all seeds that generate given max run-length

Pattern Characteristics (cont.)

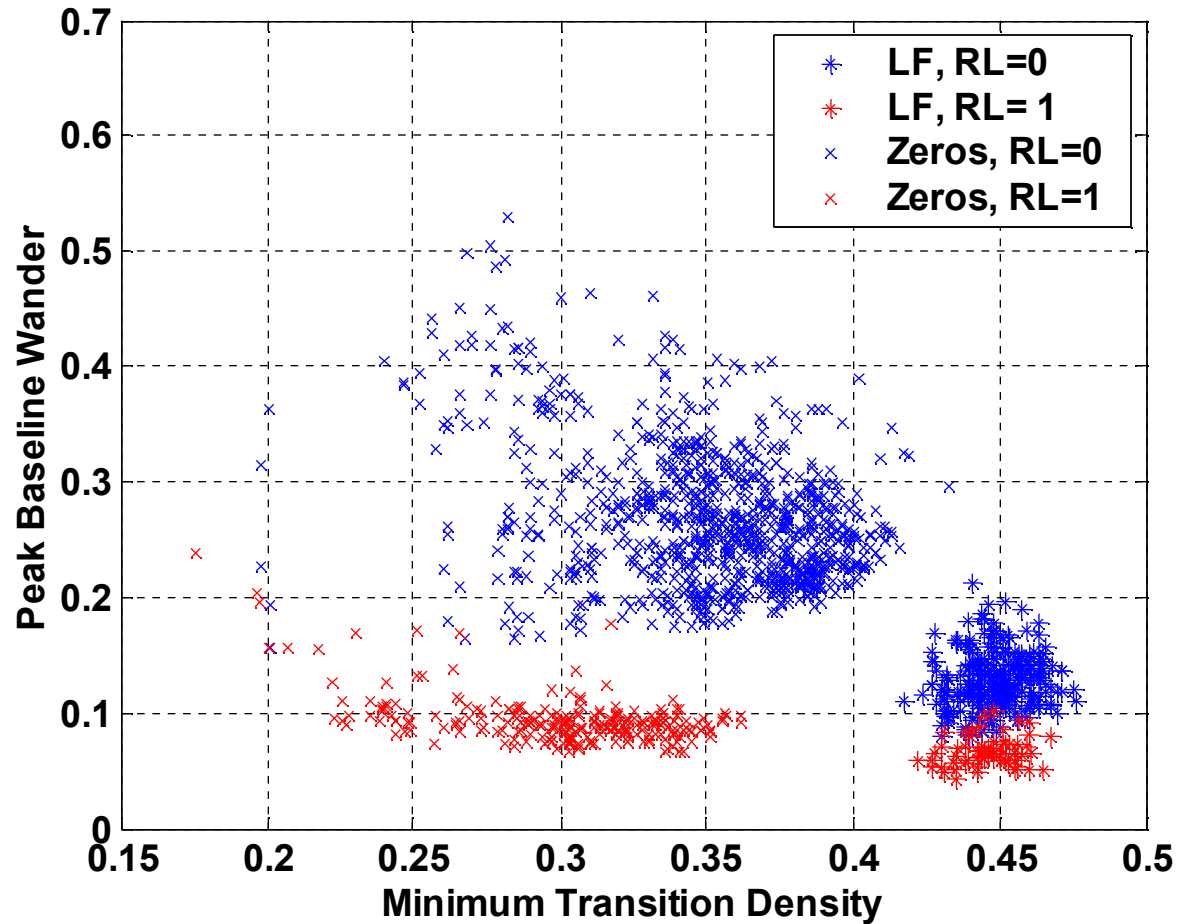
Runs of 0's, Data= LF



- Weak trends based on maximum run-length



Pattern Characteristics



- Pattern characteristics depend dramatically on:
 - LF vs. Zero data input
 - Runs of zeros vs. ones