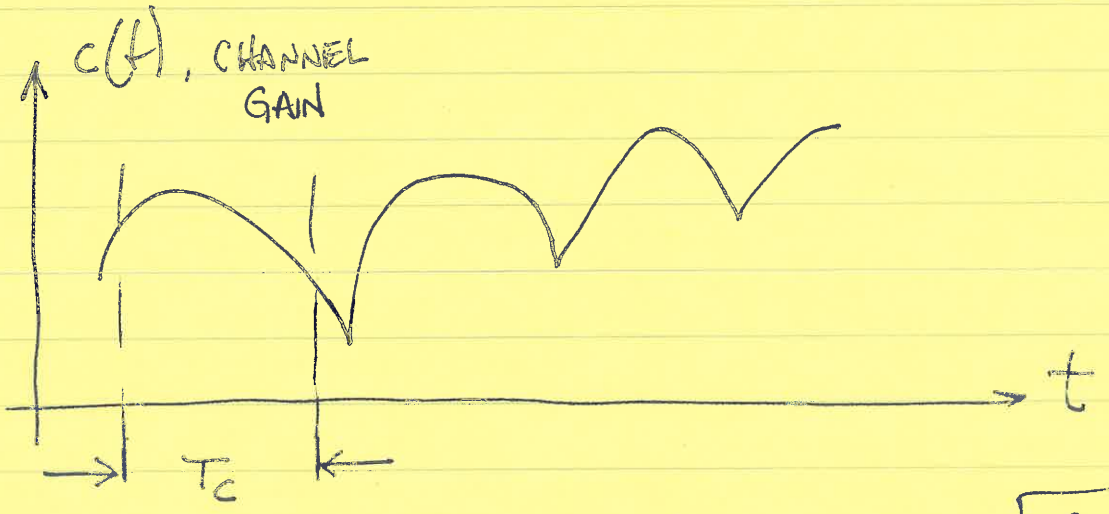
EE161

4/22/14

Interleaving for slow flat-fading channels

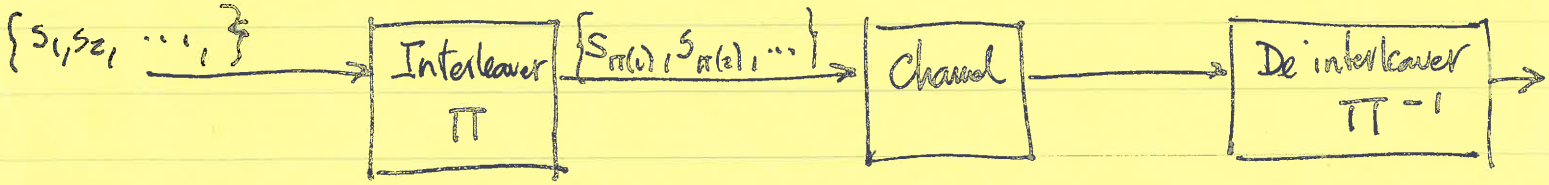
Goal: Make symbols (correlated) independent



Coherence time: $T_c = \frac{1}{B_d} = \frac{1}{2f_m} = \frac{1}{2\frac{v}{\lambda}} = \boxed{\frac{\lambda}{2v}} \sim \frac{1}{v}$.

$\Rightarrow$ "Scramble" correlated symbols (over T_c seconds) so that the received sequence has statistically independent symbols.

Interleaver (block type. There are other types)



Example: ($M = 3$, $J = 2$)

Depth 2

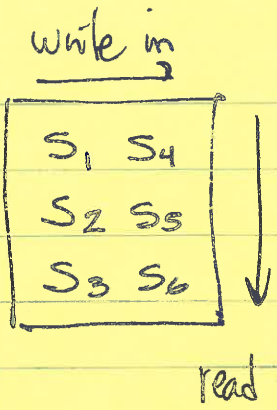
write in →

s_1	s_2	s_3
s_4	s_5	s_6

read out ↓

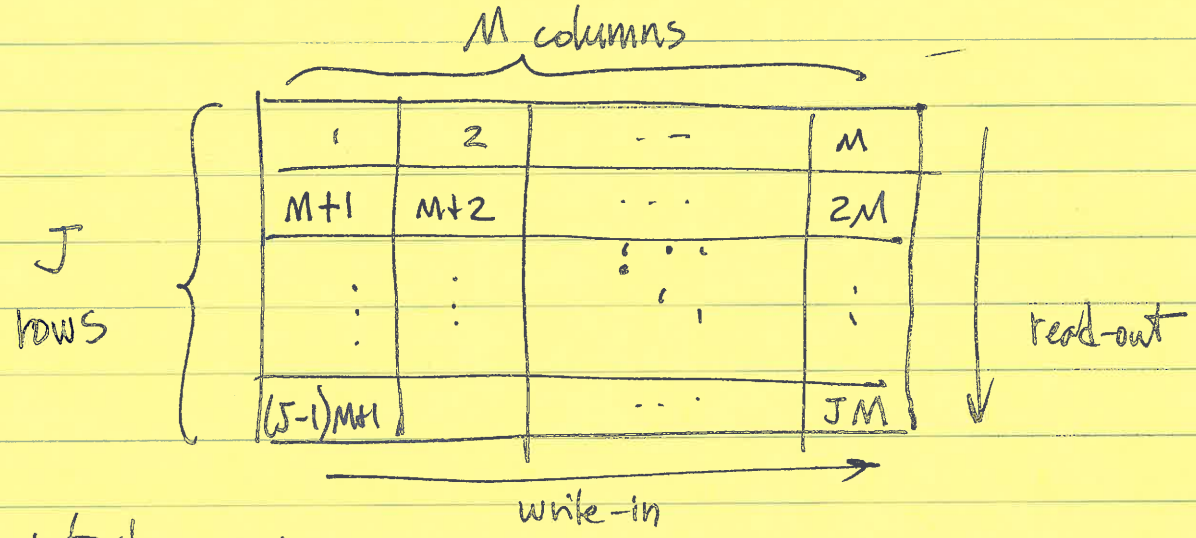
Gives $\{s_{\pi(1)}, s_{\pi(2)}, \ldots\} = \{s_1, s_4, s_2, s_5, s_3, s_6\}$

De interleaver :

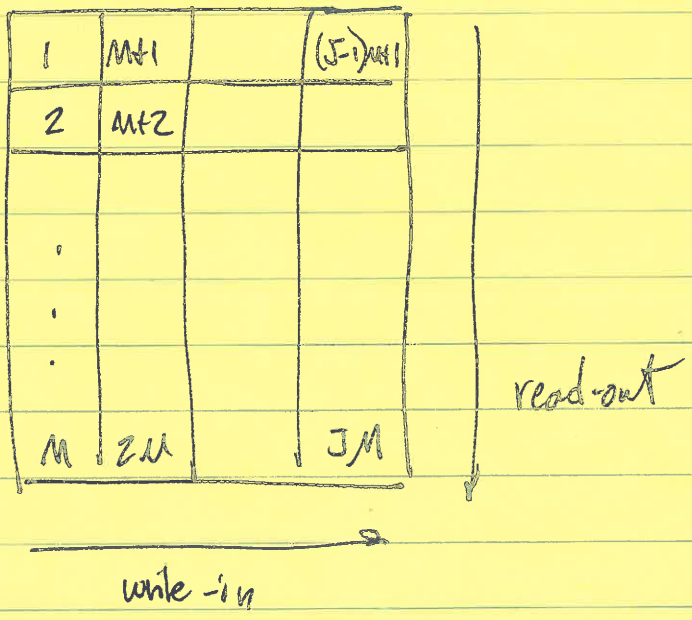


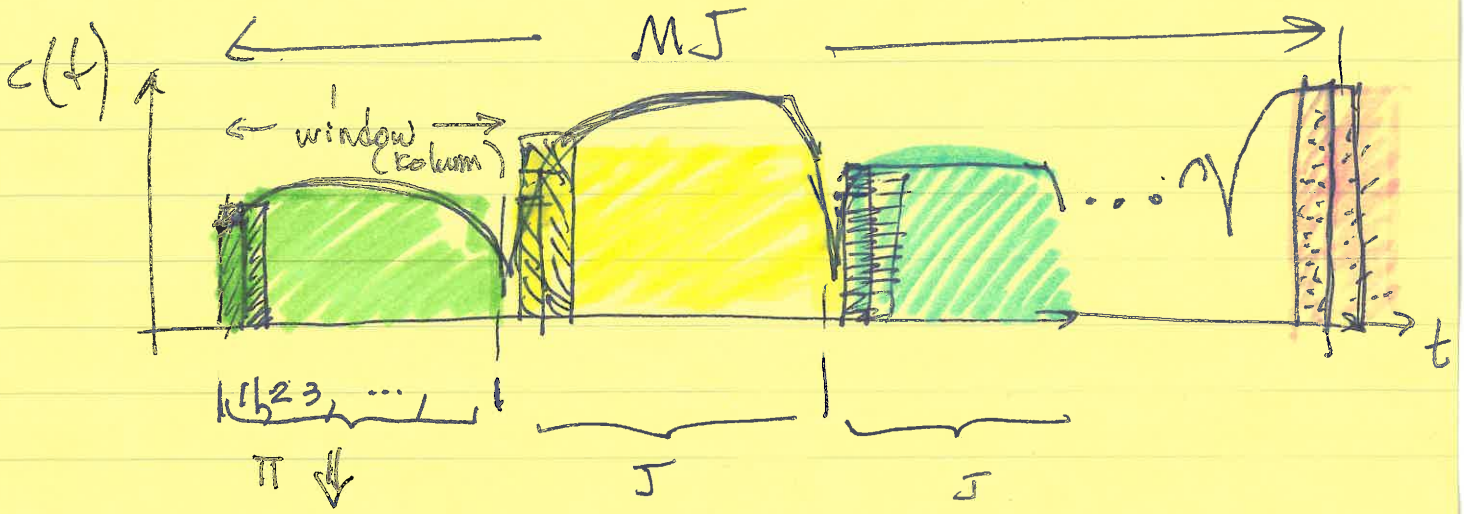
gives $\{S_1, S_2, S_3, S_4, S_5, S_6\}$

Interleaver (Indexes shown)



Deinterleaver :





$1, M+1, \dots, (J-1)M+1, 2$

J correlated symbols

Π^{-1}

DE-INTERLEAVE

BURSTS OF ERRORS

INDEPENDENT ERRORS

CHOICE OF PARAMETER M DEPENDS ON ECC LENGTH (n) AND (J)

Uncorrelated over M windows. → ERROR CORRECTING ✓✓

← M →

Uncorrelated output if :

Works if

$$JT > T_C$$

✓✓ ✓

slide

$$J > \frac{\lambda}{2\nu}\frac{1}{T} \quad \text{or} \quad J > \frac{\lambda}{2\nu} R$$