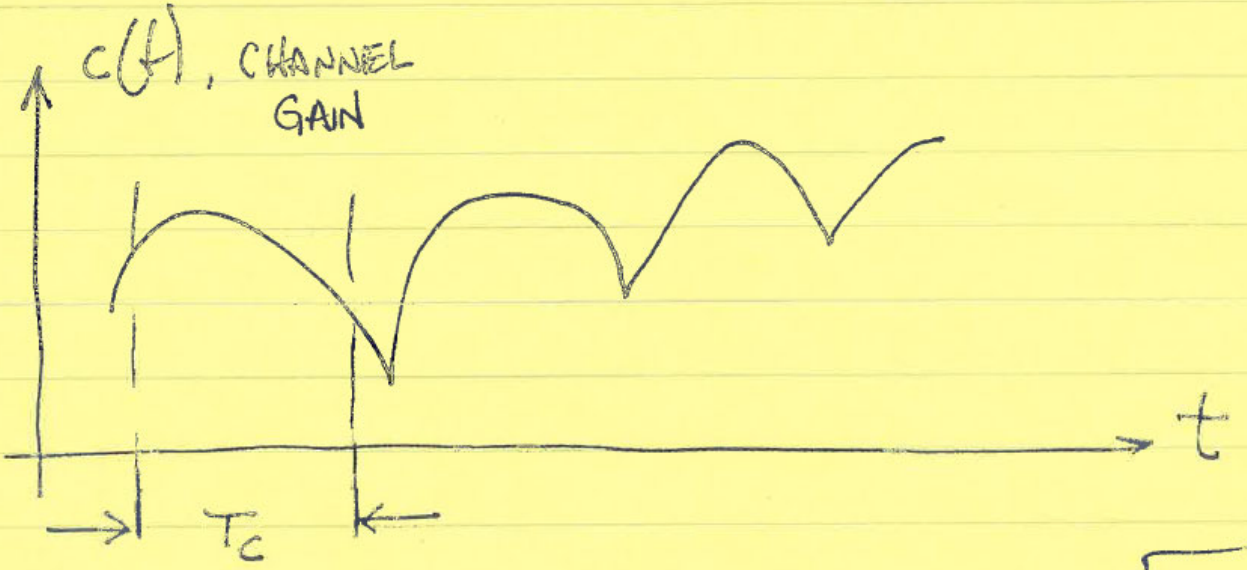
Interleaving for slow flat fading channels

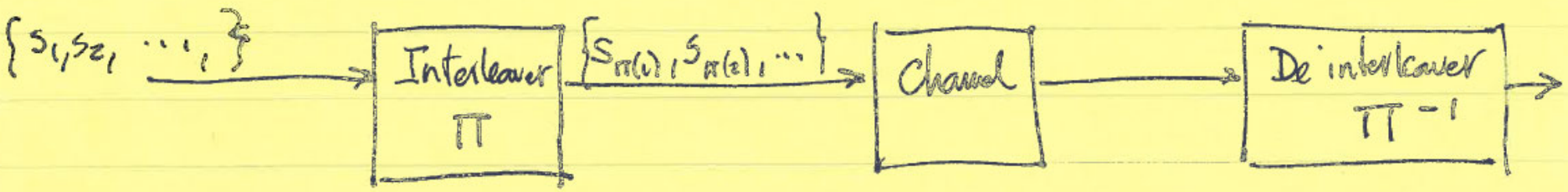
Goal: Make symbols (correlated) independent



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

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

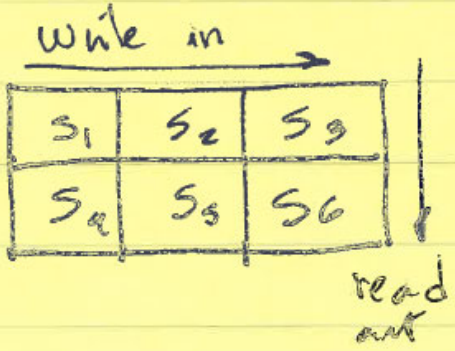
Interleaver (block type. There are other types)



Example :

$(M=3,\ J=2)$

Depth 2

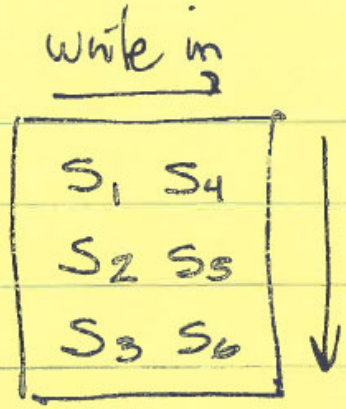


Gives

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

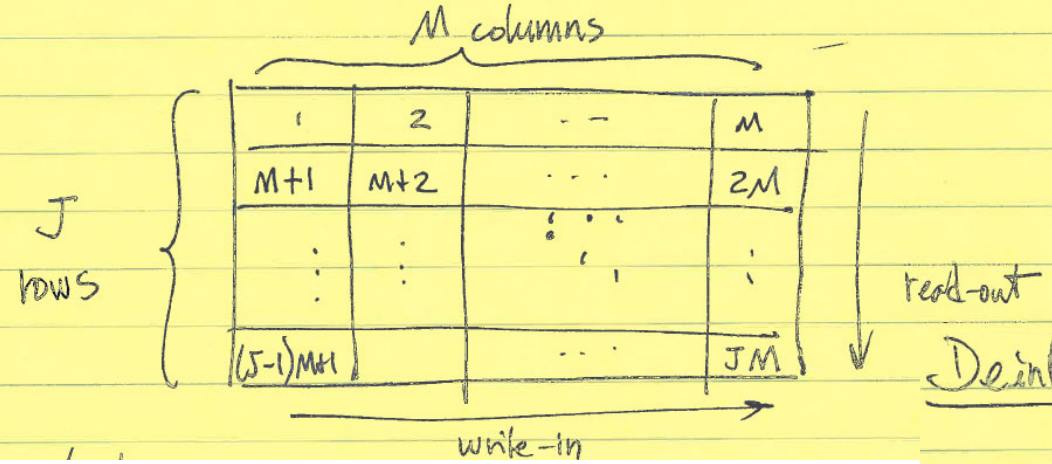
2/3

De interleaver :

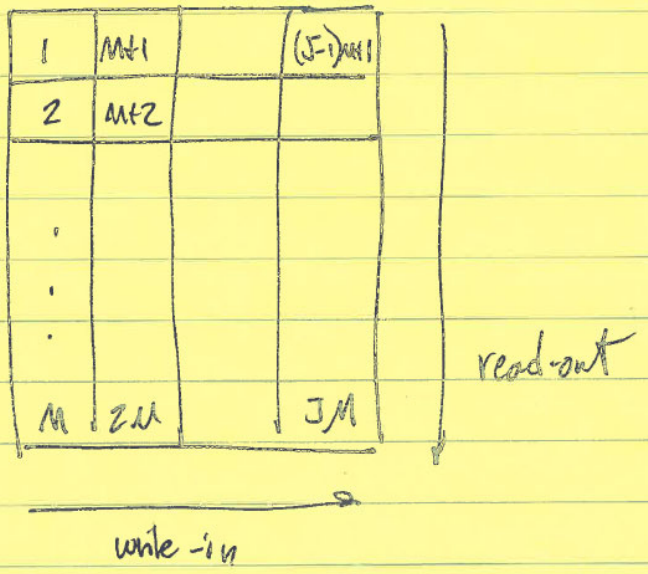


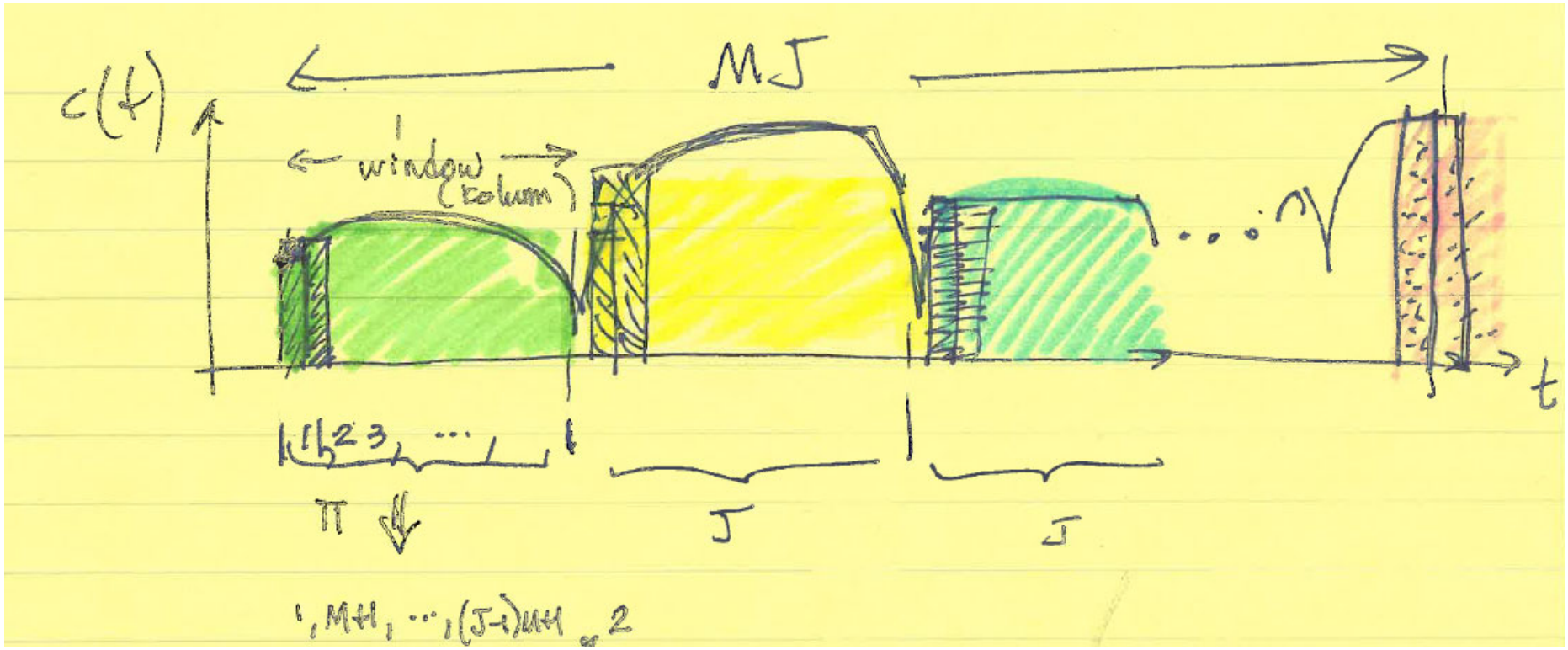
gives $\{s_1, s_2, s_3, s_4, s_5, s_6\}$

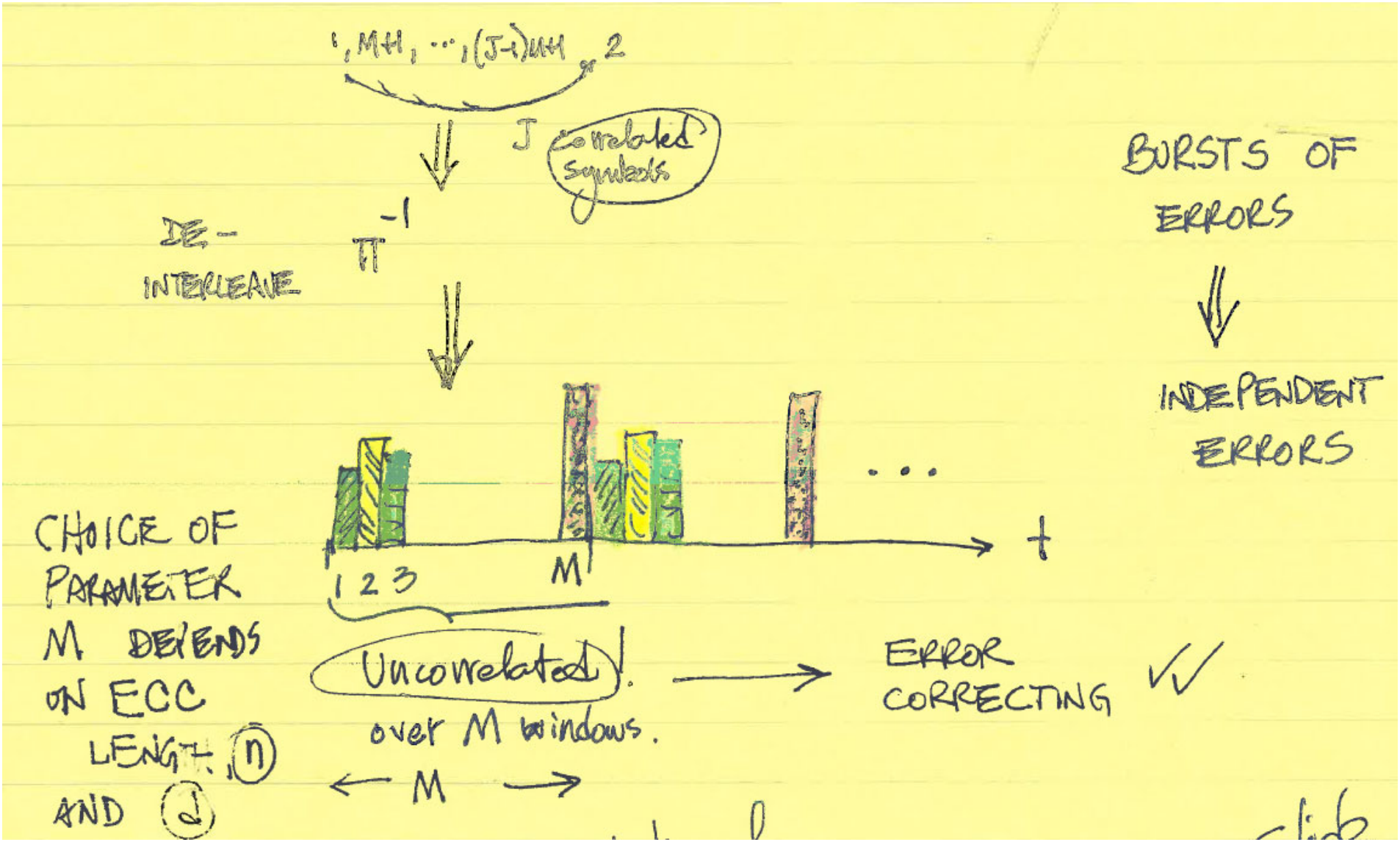
Interleaver (Indexes shown)

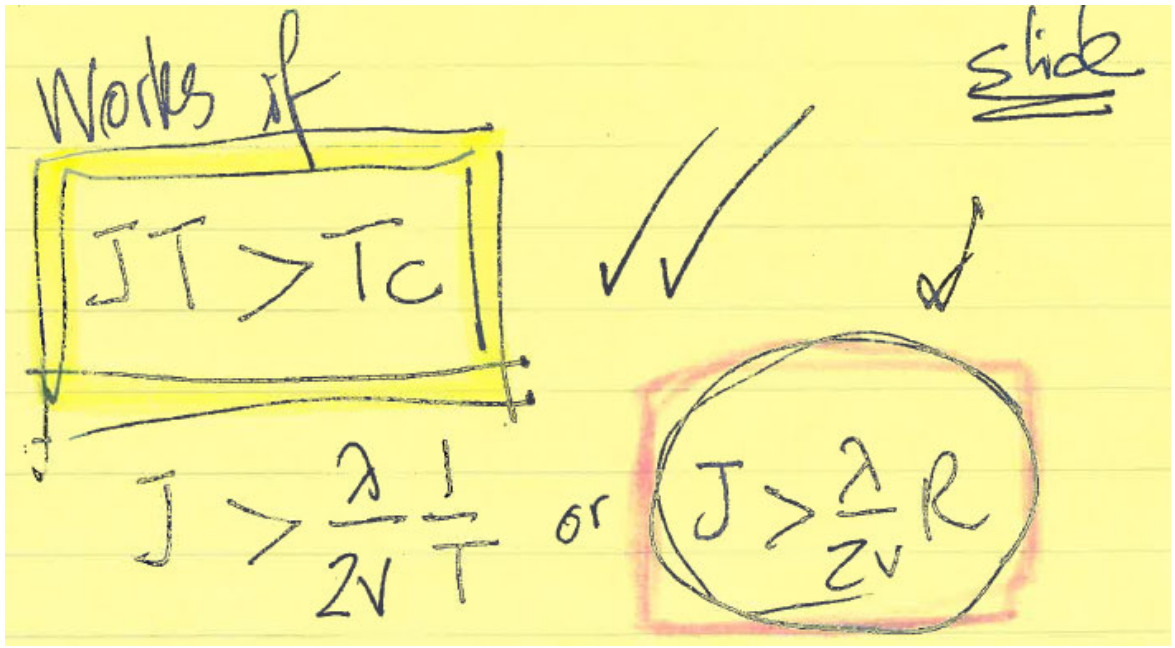


Deinterleaver:




c(t)
MJ
window (column)
t
1 2 3 ... t
Π
J
J
1, M+1, ..., (J-1)M+1
2


1, M+1, ..., (J-1)M+1, 2
J correlated Symbols
DE-INTERLEAVE
Π^{-1}
BURSTS OF ERRORS
INDEPENDENT ERRORS
CHOICE OF PARAMETER M DEPENDS ON ECC LENGTH (n) AND (J)
1 2 3
M
t
Uncorrelated over M windows.
ERROR CORRECTING
M


Works if
slide
$JT > T_c$
$J > \frac{\lambda}{2\nu} \frac{1}{T}$
or
$J > \frac{\lambda}{2\nu} R$