

Power control: why do if?

- needed for controlling interference in cellular systems
 - intercell interference occurs in all cellular systems (TDMA / FDMA/ CDMA) due to frequency reuse
 - intracell interference most serious in CDMA, can also cause ISI in TDMA
 - CDMA downlink multipath
 - CDMA uplink "near-far" effect



Power control: current wok

• current approaches:

- maintain constant received power [Fujii 1988]
- carrier-to-interference ratio balancing [Zander 1992]
- BER-based negative feedback [IS-95 standard]







Observations on power control, channel coding

- capacity of wireless multiple access link is interference-limited
- transmit minimum power needed to support desired reliability
- signal space coding offer redundancy without bandwidth expansion
- UEP signal space codes with high coding gain are difficult to generate



New work

- Idea: combine the strengths of power control and channel coding together for UP
 - exploit fixed-rate coder for high coding gain
 - use power control to provide UEP





Power control formulation

Wireless Communication Minimize the total transmit power, subject to the reliability requirement of each substream:

minimize $x_{i,m}$ = substream *i*, user m power $'E[P] = \sum \overline{\beta}_{i, m} x_{i, m}$ $\bar{\beta}_{i,m} = substream i,$ *m* users *i* substreams user m mean duty cycle s.t. \forall substreams *i*, users *m*, σ^2 = intercell $\frac{G_m x_{i,m}}{\sigma^2 + f \sum G_n \sum \overline{\beta}_{j,n} x_{j,n}} \ge SNR_{i,m}$ interference $G_m = path loss$ $n \neq m$ i $x_i \ge 0$, $SNR_{i,m} > 0$ crosscorrelation

