Power Allocation

- optimal power allocation is given by the Water-Filling algorithm

$$P_n^* = \max\left(0,\ \varepsilon - \frac{\sigma_n^2}{|\alpha_n|^2}\right)$$

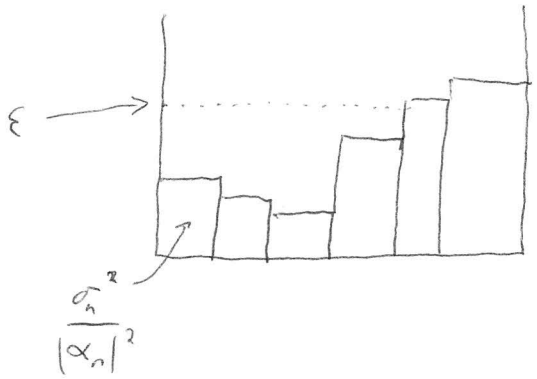
$$\text{Subject to} \quad P = \sum_{n=1}^{N} P_n^*$$

P – total power

P_n^* – optimal power for subcarrier n

σ_n^2 – noise variance for subcarrier n

α_n – gain for subcarrier n

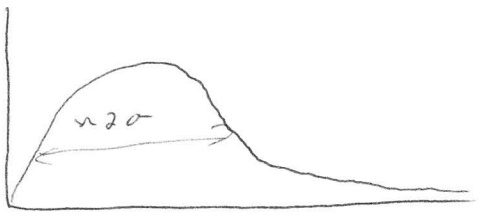


- no closed form solution for arbitrary channels. Solution can be found iteratively.
- In general, waterfilling is optimal for parallel channels of different capacities (e.g. MIMO)

Statistical Channel Models

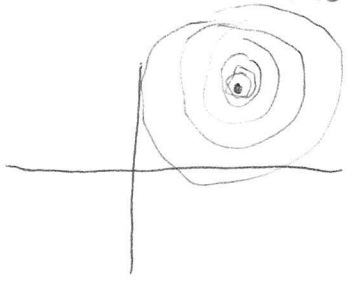
Rayleigh Fading

- Large number of interacting objects without a dominant component
- The channel is the sum of multipath components of roughly equal power and random phase
- ~~The magnitude of the channel is a sum of~~
- The I/Q components of the channel are uncorrelated zero-mean Gaussians, so the channel magnitude is a Rayleigh Distribution



Ricean Fading

- Large number of interacting objects with a dominant component
- The channel is a 2D Gaussian centered around some point



- The amplitude distribution becomes a Ricean distribution