

# Threshold

## 1 Neumann Series

We review Neumann Series from Wikipedia.

$$(I - T)^{-1} = \sum_{k=0}^{\infty} T^k \quad (1)$$

### 1.1 Approximate Matrix Inversion of LMMSE

If we set  $T = -T$ ,

$$(I + T)^{-1} = \sum_{k=0}^{\infty} (-1)^k T^k. \quad (2)$$

Let's look at linear MMSE equations

$$\begin{aligned} \hat{x} &= (H^H H + \sigma^2 I)^{-1} H^H y \\ &= \frac{\sigma^2}{\sigma^2} (H^H H + \sigma^2 I)^{-1} H^H y \\ &= \frac{1}{\sigma^2} \left( \frac{H^H H}{\sigma^2} + I \right)^{-1} H^H y \\ &= \frac{1}{\sigma^2} \sum_{k=0}^{\infty} (-1)^k \left( \frac{H^H H}{\sigma^2} \right)^k H^H y \\ &= \sum_{k=0}^{\infty} (-1)^k \left( \frac{1}{\sigma^2} \right)^{k-1} (H^H H)^k H^H y \end{aligned} \quad (3)$$