

Orthogonal Decomposition of Vector y

$$\begin{aligned}\mathbb{R}^n &= V_1 \oplus V_2 \oplus V_3 \\ y &= P_1y + P_2y + P_3y \\ \|y\|^2 &= \|P_1y\|^2 + \|P_2y\|^2 + \|P_3y\|^2\end{aligned}$$

