Have a look at the following links:

1. Orthogonal complement
2. Orthogonal decomposition

The key points are

- If we look at an n-dimensional vector space V and a k-dimensional subspace $W \subset V$, then the orthogonal complement $W^\perp$ is an $(n-k)$-dimensional subspace of V and contains all vectors in V that are orthogonal to every vector in W.
- Every vector $\mathbf{x} \in V$ can be (uniquely) decomposed into $\mathbf{x} = \sum_{i=1}^{k} \lambda_i \mathbf{b}_i + \sum_{j=1}^{n-k} \psi_j \mathbf{b}_j^\perp$, $\lambda_i, \psi_j \in \mathbb{R}$, where $\mathbf{b}_1, \ldots, \mathbf{b}_k$ is a basis of W and $\mathbf{b}_1^\perp, \ldots, \mathbf{b}_{n-k}^\perp$ is a basis of $W^\perp$.

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