$$\min_{x_{n+1}} -\frac{1}{\sigma_n^2(x_{n+1})}\int_D \left(k(x, x_{n+1}) - k_n^T(x_{n+1})\cdot K_n^{-1}\cdot k_n(x)\right)^2 dP(x)$$

$$k(x, x_1) = \sum_{i\in I} \lambda_i \cdot \phi_i(x)\cdot \phi_i(x_1)$$

$$k_n(x) = \left[\sum_i \lambda_i\, \phi_i(x)\, \phi_i(x_j)\right]_j^T$$

$$K_n = \left(k(x_i, x_j)\right)_{ij}$$

$$= \left(\sum_t \lambda_t\, \phi_t(x_i)\, \phi_t(x_j)\right)_{ij}$$

$$\begin{cases} \phi(x_i) = [\phi_1(x_i)\ \ \phi_2(x_i)\ \ \cdots] \\ \Phi = [\phi(x_1)\ \cdots\cdots\ \phi(x_n)]^T \\ \Lambda = \mathrm{diag}(\lambda_1, \cdots\cdots) \end{cases}$$

$$\Rightarrow k(x, x_{n+1}) - k_n^T(x_{n+1})\cdot K_n^{-1}\cdot k_n(x)$$

$$= \phi^T(x)\cdot\Lambda\cdot\phi(x_{n+1}) - \left(\Phi\Lambda\cdot\phi(x_{n+1})\right)^T \left(\Phi\Lambda\Phi^T\right)^{-1}\cdot\left(\Phi\cdot\Lambda\cdot\phi(x)\right)$$

$$= 0. \quad \text{if } |I| < \infty$$