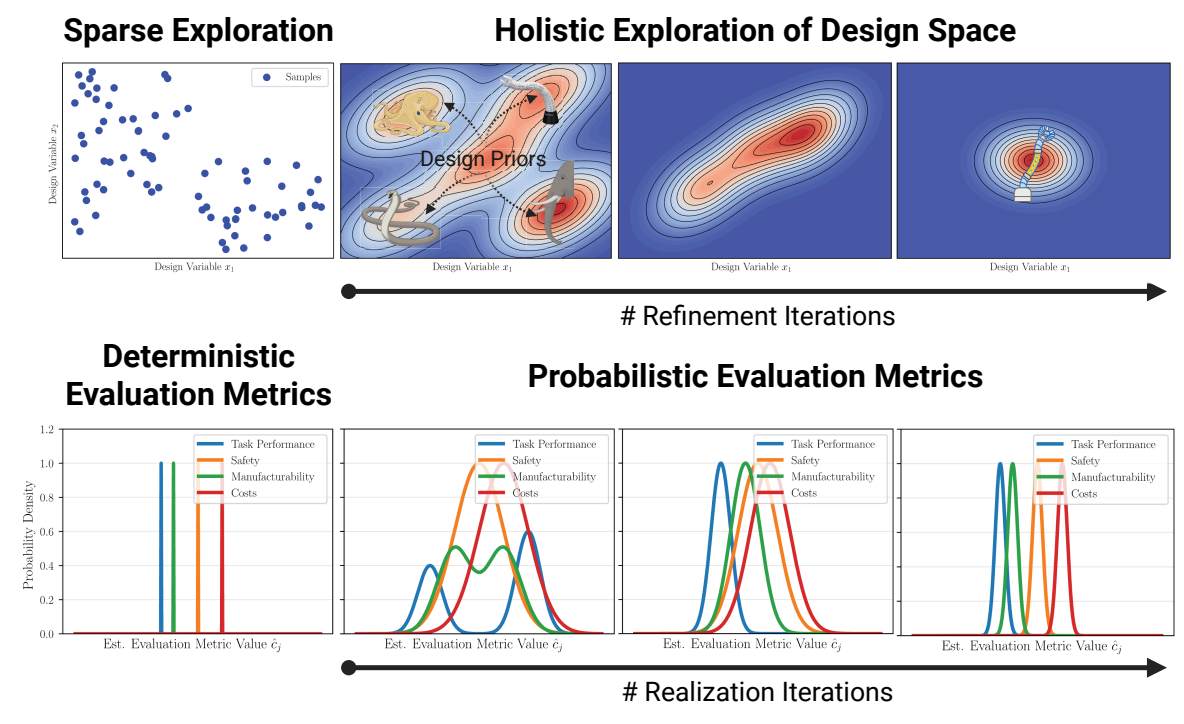
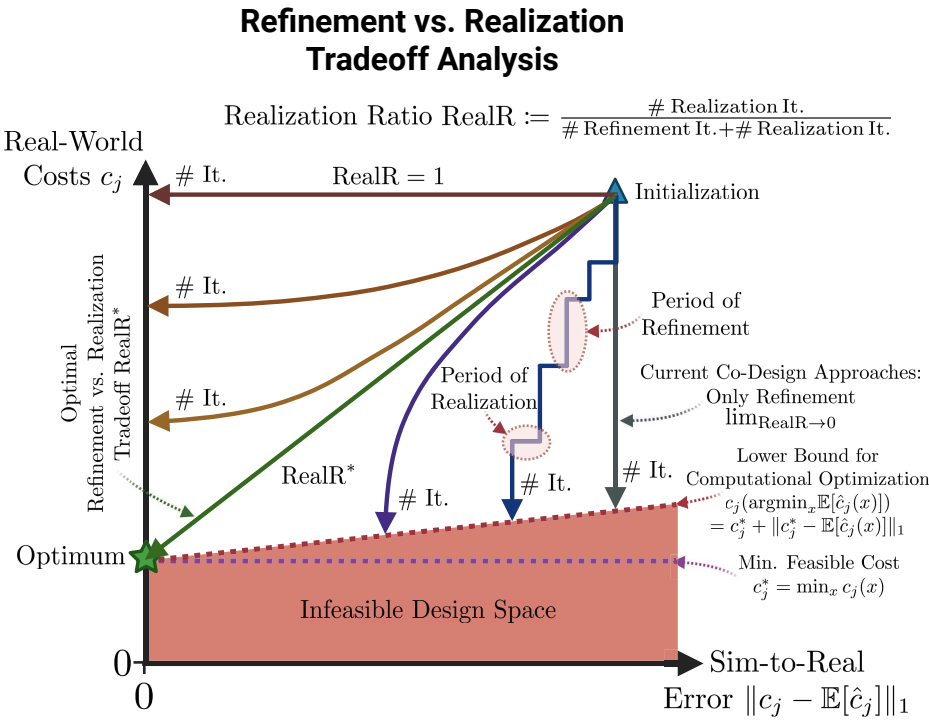

Sparse Exploration
Holistic Exploration of Design Space
Samples
Design Variable x_2
Design Variable x_1
Design Priors
Refinement Iterations
Deterministic Evaluation Metrics
Probabilistic Evaluation Metrics
Task Performance
Safety
Manufacturability
Costs
Probability Density
Est. Evaluation Metric Value $\hat{c}_j$
Realization Iterations


Refinement vs. Realization Tradeoff Analysis
Realization Ratio RealR := # Realization It. / # Refinement It. + # Realization It.
Real-World Costs c_j
# It.
RealR = 1
Initialization
Optimal Refinement vs. Realization Tradeoff RealR*
Period of Refinement
Period of Realization
Current Co-Design Approaches: Only Refinement $\lim_{\text{RealR}\to 0}$
RealR*
Lower Bound for Computational Optimization
$c_j(\text{argmin}_x \mathbb{E}[\hat{c}_j(x)])$
$= c_j^* + \|c_j^* - \mathbb{E}[\hat{c}_j(x)]\|_1$
Optimum
Min. Feasible Cost
$c_j^* = \min_x c_j(x)$
Infeasible Design Space
0
Sim-to-Real Error $\|c_j - \mathbb{E}[\hat{c}_j]\|_1$