Joint Limits Analysis - Enhanced Analysis with Actual Franka Limits **Minimum Distance to Joint Limits Average Distance to Joint Limits** 1.4 Critical (0.2 rad) 0 2.00 Caution (0.5 rad) n=12 n=17 **--** Safe (1.0 rad) Median: 0.63 Median: 1.10 1.2 Mean: 1.02 1.75 1.0 1.50 Distance (radians) Distance (radians) 1.25 • • 0 0.75 0.4 0.2 Critical (0.2 rad) Caution (0.5 rad) 0.25 **--** Safe (1.0 rad) 0.0 Newton-Raphson SA-Optimized Newton-Raphson SA-Optimized IK Method IK Method Joint Limits Distance Comparison (Min vs Avg vs Max) **Joint Limits Safety Compliance Rates** 3.0 94.1% 94.1% Distance Type Method Average Newton-Raphson SA-Optimized Maximum Minimum 2.5 80 76.5% 66.7% Compliance Rate (%) 6 9 58.3% 0 0 20 0.5 16.7% 0 0.0 Caution (0.5 rad) SA-Optimized Critical Newton-Raphson Safe (0.2 rad) (1.0 rad) IK Method Safety Threshold