**Table S2. Summary of available constraint terms for Tracking, Verification, and Design Optimization.**

| Constraint Term | Component Type | Tracking Optimization | Verification Optimization | Design Optimization |
|---|---|:---:|:---:|:---:|
| generalized_coordinate_deviation | coordinate | ✓ | ✓ | ✓ |
| generalized_coordinate_value | coordinate | ✓ | ✓ | ✓ |
| generalized_coordinate_periodicity | coordinate | ✓ | ✓ | ✓ |
| initial_generalized_coordinate_deviation | coordinate | ✓ | ✓ | ✓ |
| initial_generalized_coordinate_value | coordinate | ✓ | ✓ | ✓ |
| final_generalized_coordinate_deviation | coordinate | ✓ | ✓ | ✓ |
| final_generalized_coordinate_value | coordinate | ✓ | ✓ | ✓ |
| generalized_speed_deviation | coordinate | ✓ | ✓ | ✓ |
| generalized_speed_value | coordinate | ✓ | ✓ | ✓ |
| generalized_speed_periodicity | coordinate | ✓ | ✓ | ✓ |
| initial_generalized_speed_deviation | coordinate | ✓ | ✓ | ✓ |
| initial_generalized_speed_value | coordinate | ✓ | ✓ | ✓ |
| final_generalized_speed_deviation | coordinate | ✓ | ✓ | ✓ |
| final_generalized_speed_value | coordinate | ✓ | ✓ | ✓ |
| generalized_acceleration_deviation | coordinate | ✓ | ✓ | ✓ |
| generalized_acceleration_value | coordinate | ✓ | ✓ | ✓ |
| marker_position_deviation | marker | ✓ | ✓ | ✓ |
| marker_position_value | marker | ✓ | ✓ | ✓ |
| marker_position_periodicity | marker | ✓ | ✓ | ✓ |
| initial_marker_position_deviation | marker | ✓ | ✓ | ✓ |
| initial_marker_position_value | marker | ✓ | ✓ | ✓ |
| final_marker_position_deviation | marker | ✓ | ✓ | ✓ |
| final_marker_position_value | marker | ✓ | ✓ | ✓ |
| marker_velocity_deviation | marker | ✓ | ✓ | ✓ |
| marker_velocity_value | marker | ✓ | ✓ | ✓ |
| marker_velocity_periodicity | marker | ✓ | ✓ | ✓ |
| initial_marker_velocity_deviation | marker | ✓ | ✓ | ✓ |
| initial_marker_velocity_value | marker | ✓ | ✓ | ✓ |
| final_marker_velocity_deviation | marker | ✓ | ✓ | ✓ |
| final_marker_velocity_value | marker | ✓ | ✓ | ✓ |
| body_orientation_deviation | body | ✓ | ✓ | ✓ |
| body_orientation_value | body | ✓ | ✓ | ✓ |
| body_orientation_periodicity | body | ✓ | ✓ | ✓ |
| initial_body_orientation_deviation | body | ✓ | ✓ | ✓ |
| initial_body_orientation_value | body | ✓ | ✓ | ✓ |
| final_body_orientation_deviation | body | ✓ | ✓ | ✓ |
| final_body_orientation_value | body | ✓ | ✓ | ✓ |
| kinetic_consistency | load | ✓ | ✓ | ✓ |
| root_segment_residual_load | load | ✓ | ✓ | ✓ |
| root_segment_residual_load_periodicity | load | ✓ | ✓ | ✓ |
| external_force_deviation | force | ✓ | ✓ | ✓ |

| | | | | |
|---|---|---|---|---|
| external_force_value | force | ✓ | ✓ | ✓ |
| external_force_periodicity | force | ✓ | ✓ | ✓ |
| initial_external_force_deviation | force | ✓ | ✓ | ✓ |
| initial_external_force_value | force | ✓ | ✓ | ✓ |
| final_external_force_deviation | force | ✓ | ✓ | ✓ |
| final_external_force_value | force | ✓ | ✓ | ✓ |
| external_moment_deviation | moment | ✓ | ✓ | ✓ |
| external_moment_value | moment | ✓ | ✓ | ✓ |
| external_moment_periodicity | moment | ✓ | ✓ | ✓ |
| initial_external_moment_deviation | moment | ✓ | ✓ | ✓ |
| initial_external_moment_value | moment | ✓ | ✓ | ✓ |
| final_external_moment_deviation | moment | ✓ | ✓ | ✓ |
| final_external_moment_value | moment | ✓ | ✓ | ✓ |
| center_of_pressure_deviation | hindfoot_body | ✓ | | ✓ |
| center_of_pressure_value | hindfoot_body | ✓ | | ✓ |
| synergy_vector_sum | synergy_group | ✓ | | ✓ |
| synergy_vector_magnitude | synergy_group | ✓ | | ✓ |
| limit_muscle_activation | muscle | | | ✓ |
| limit_normalized_fiber_length | muscle | | | ✓ |
| user_defined | any | | | ✓ |