

For given unstable configuration \mathbf{q}_{given} we can find the closest stable \mathbf{q} using the following optimization problem.

$$\begin{aligned}
& \underset{\mathbf{q}}{\text{minimize}} && ||\mathbf{q} - \mathbf{q}_{given}||^2 \\
& \text{subject to} && CoM_{xy}(\mathbf{q}) \in \Omega \quad (\Omega \text{ is the Support Polygon}) \\
& && r(\mathbf{q}) = r_0 \\
& && \mathbf{q}_{min} \leq \mathbf{q} \leq \mathbf{q}_{max}
\end{aligned}$$

Where $CoM_{xy}(\mathbf{q})$ is the projection of center of mass for the robot into XY-plane, Ω is support polygon in world frame. $r(\mathbf{q})$ the position of the foot in contact with the ground that must be the same r_0 for the robot to maintains contact. \mathbf{q}_{min} and \mathbf{q}_{max} are the limit for the configuration \mathbf{q} .