Minimization using Lagrange Multipliers

- Lagrange Objective function is formed,

$$\text{Maximize } F(\alpha_i, \lambda_i) = -f(\alpha_i) - \lambda_1 h_1 - \lambda_2 h_2 - \ldots \lambda_{(m+2)} h_{(m+2)} - \mu g$$

- Taking partial derivative we form the system of polynomial equations given by,

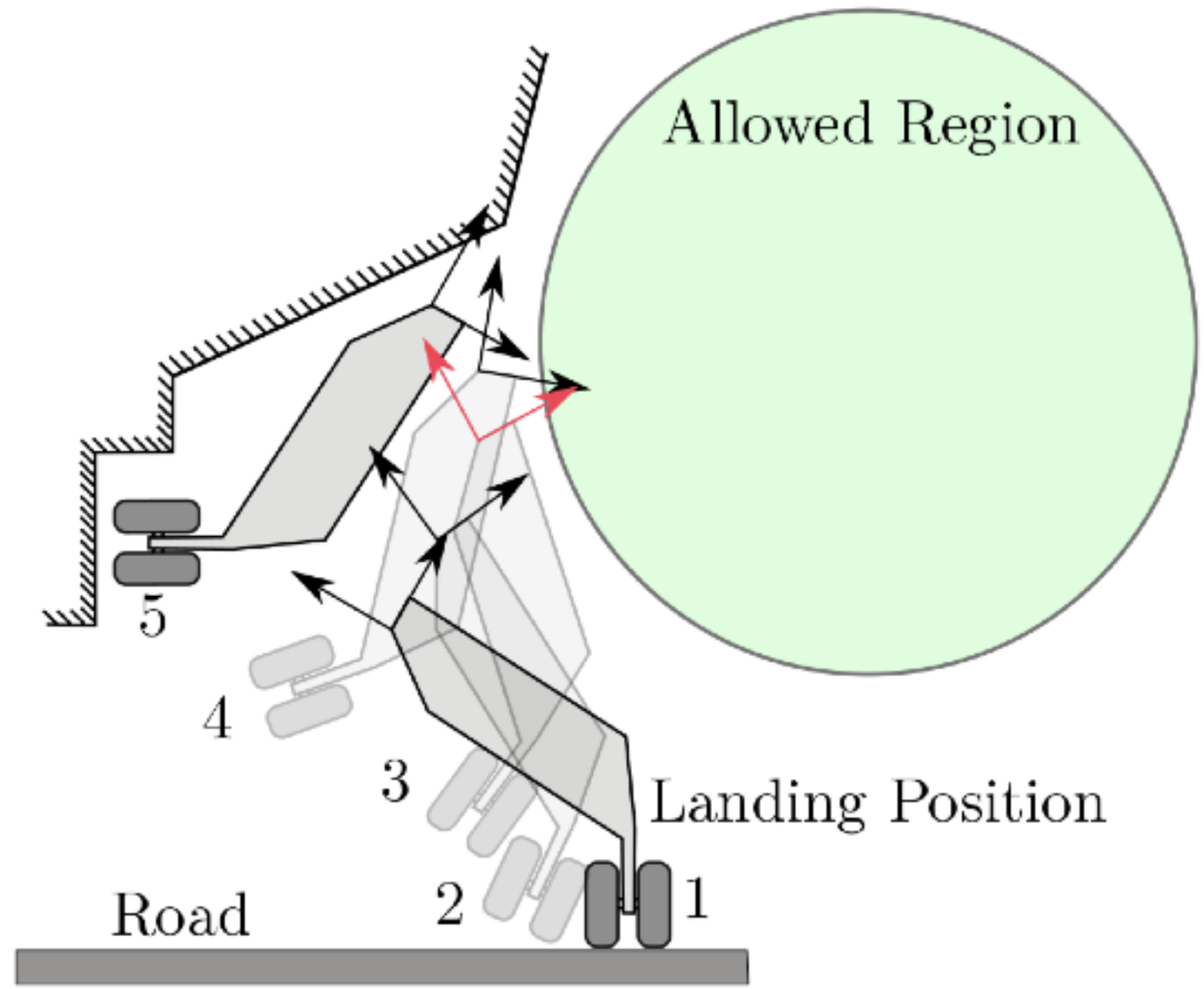
$$\frac{\partial}{\partial \alpha_2}(F) = 0, \frac{\partial}{\partial \alpha_3}(F) = 0, \ldots, \frac{\partial}{\partial \alpha_{(8-n)}}(F) = 0,$$

$$\frac{\partial}{\partial \lambda_1}(F) = 0, \frac{\partial}{\partial \lambda_2}(F) = 0, \ldots, \frac{\partial}{\partial \lambda_{(m+2)}}(F) = 0.$$

along with Karush-Kuhn-Tucker conditions

$$\mu \frac{\partial}{\partial \mu}(F) = 0, \text{feasibility: } g \leq 0, \text{optimality: } \mu \geq 0$$

Example : Landing Gear

Synthesize a four-bar linkage such that,

- Mechanism passes through precision poses 1-2-4-5
- Closely Approximates third pose
- Fixed pivots desired to lie on or inside the allowed region.