**State Equations:**

**Measurements:**

**Model Parameters:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Description** | **Unit** | **Value** |
|  | Vehicle’s velocity along the direction of  vehicle frame |  | State |
|  | Vehicle’s coordinates in the world  frame |  | State |
|  | Body yaw angle, angular speed |  | State |
|  | Front wheel angle |  | Input |
|  | Total input force |  | Input |
|  | Vehicle mass |  | 1888.6 |
|  | Length from rear tire to the center of  mass |  | 1.39 |
|  | Length from front tire to the center of  mass |  | 1.55 |
|  | Cornering stiffness of each tire |  | 20000 |
|  | Yaw inertia |  | 25854 |
|  | Tire Force, , |  | Depends on input force |
|  | Rolling resistance coefficient |  | 0.019 |
|  | Simulation timestep |  | 0.032 |

1. **Linearization**

**Lateral Linearization**

Assume are constant in the lateral system.

Non-linearized System:

Apply small angle Approximations

**Longitudinal Linearization**

Assume are constant in the longitudinal linearization

Non-linearized System:

Dynamics of rolling accommodate for using a disturbance term