

Vehicle Dynamics

1. Static weight distribution, and its modifying factors
 - Axle loads in steady, leveled condition.
 - Axle loads during acceleration, climbing uphill, during tow, and caused by air resistance
 - Inclination resistance
2. Cornering, weight distribution, side-skidding, and roll-over limits
 - Force balance during cornering. Centrifugal, centripetal forces
 - Determining the yaw-rate
 - Rolling balance, skidding balance
3. Pull-force balance, resistances
 - Components of the pull force balance equation, and
 - Detailed explanations of the components.
4. Pull diagram, and consequences
 - Pull force, and vehicle speed equation from engine, vehicle, and tyre data.
 - Draw the pull force curves for at least 3 gears.
 - Draw the resistance curves
 - Draw the theoretical ideal pull-force hyperbole, and explain
 - Draw conclusions about maximum speeds (theoretical, and practical)
5. Longitudinal slip, and tire forces
 - Slip definitions for pull, and brake
 - Explain the origin of the slip phenome
 - Is slip a loss?
 - Show normalized the tire forces in the range $s: [-1,1]$, and explain stable, and unstable ranges
 - Explain additional braking effect for certain soil types
6. Lateral slip, and side force
 - Lateral slip definition (side-skidding angle)
 - Explain the origin of the side-skidding phenome
 - What influences the side-skidding?
 - Which vehicle dynamic property is being influenced by side-skidding?
7. Ackermann condition of turning.
 - Explain Ackermann condition on a drawing of a 4-wheeled vehicle
 - Explain the steering angle differences between inner and outer wheels.
 - Determine the outer wheel steering angle based on the inner wheel angle
8. Neutral-, over-, and understeering conditions

- Create drawings for the 3 cases
 - Explain the conditions based on the side skidding angles
 - Show the steering wheel angle as a function of vehicle speed for the 3 cases
9. Multi-mass dynamic models of vehicle suspension
- Draw models for 1, 2, 3, and 5 mass models.
 - Which model is used for which type of modelling?
10. Differential equation modelling of vehicle dynamics.
- Draw an at least 2 mass vehicle model
 - Set up the motion equations
 - Write up the differential equation (at least 2nd order)
 - Create a block model based on the differential equation.
 - Explain the solution possibilities of the model created.