Point technique n°1

1) Différentiel mécanique

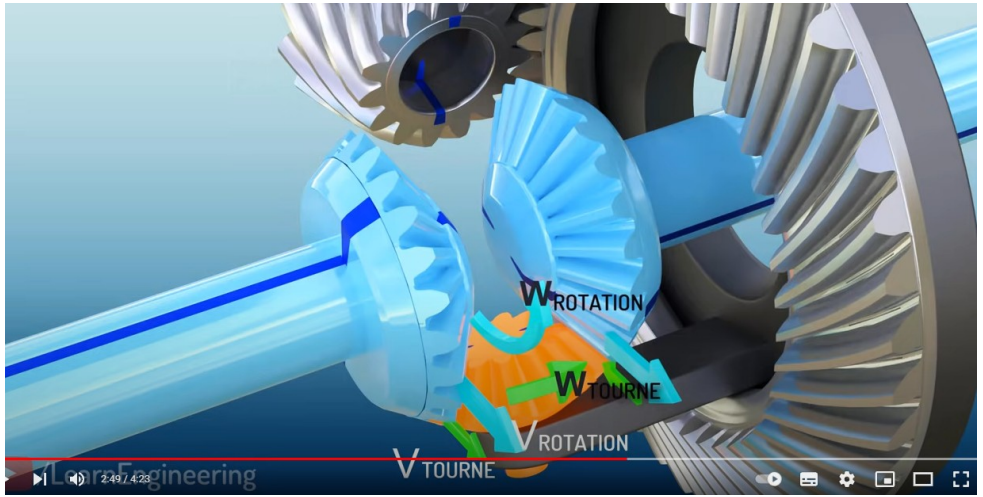
2) Commande électrique des moteurs

3) Principes et modèles existants

4) Avancement modèle Simulink

5) Questionnements techniques

1) Différentiel mécanique



https://www.youtube.com/watch?v=qXoCHETmJ0k

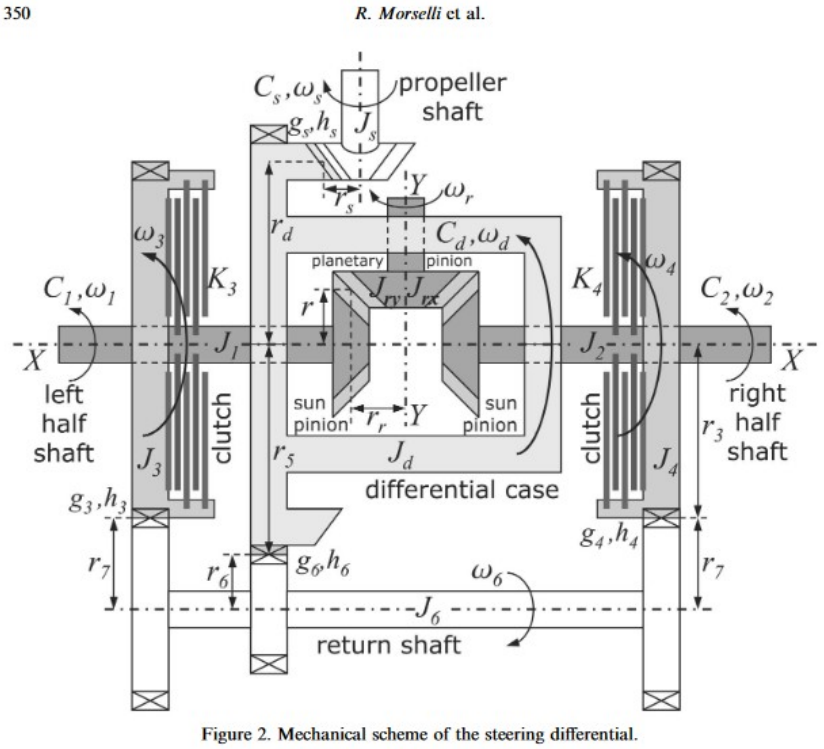


Figure 2. Mechanical scheme of the steering differential.

https://www.tandfonline.com/doi/epdf/10.1080/13873950500066959?needAccess=true

1) Différentiel mécanique

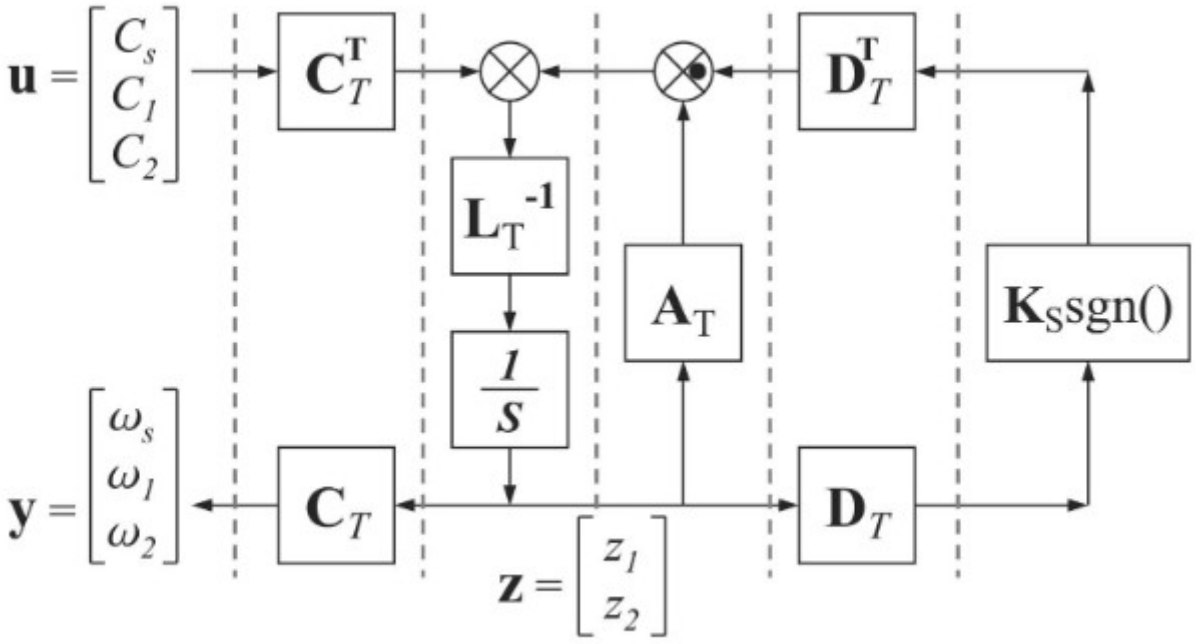


Figure 4. Scheme for the simulation of the reduced transformed system (7).

https://www.tandfonline.com/doi/epdf/10.1080/13873950500066959?needAccess=true

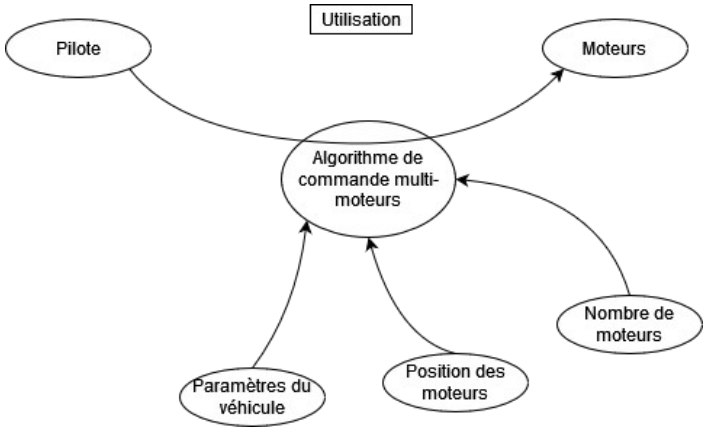
2) Commande électrique des moteurs

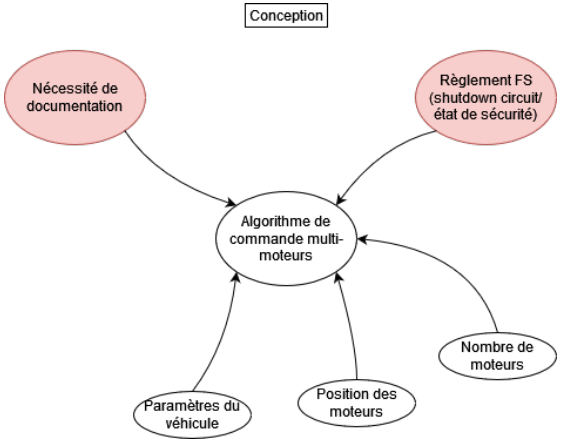
- Liberté d'implémentation

- Liberté sur la stratégie de commande → objet du stage

- Choix des grandeurs à contrôler à faire

- Dépendance aux moteurs utilisés et à leur nombre





3) Principes existants

- Vitesse de rotation des moteurs
- Slip-ratio
- Couple
- Moment de lacet

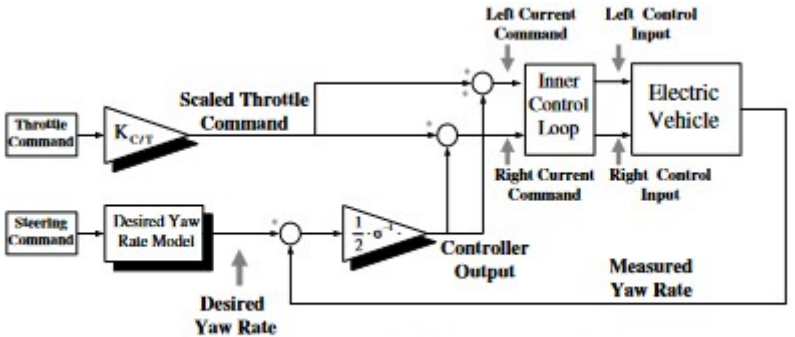


Fig. 3. Block diagram of yaw rate control loop.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4739021

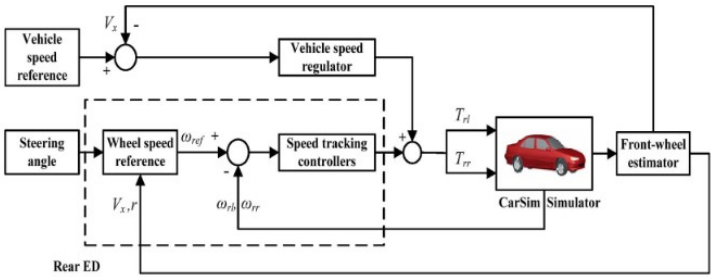


Fig. 7. Configuration of the rear ED design.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6152168

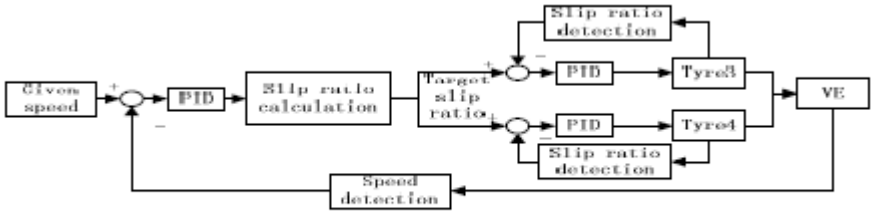
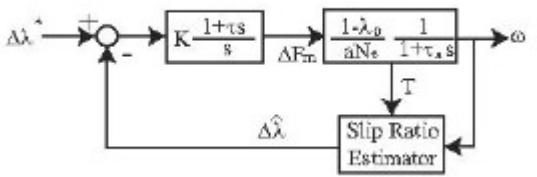


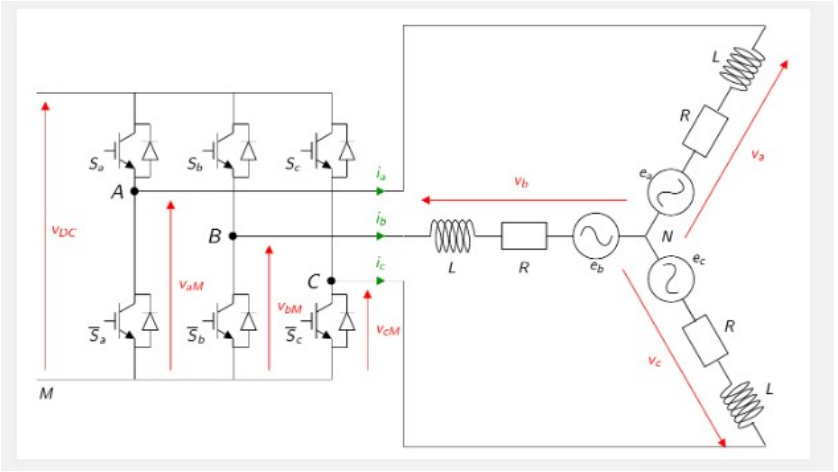
Fig. 4. Block diagram of the closed loop electric differential control strategy

Research on Electric Differential for Steering Electric Vehicles
Zitong Wang, Wei Yao, and Wei Zhang

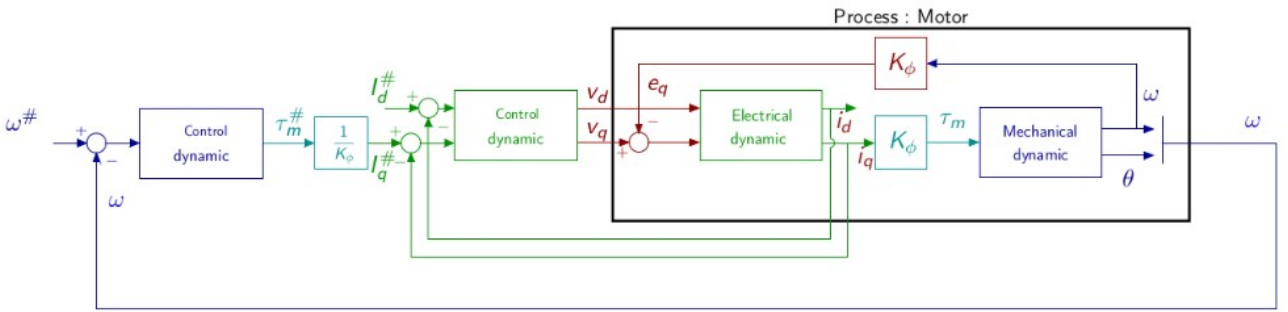


https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4239230

3) Modèles existants - MSAP



rcp.ctrl-elec.fr



3- Modèles existants - Virage

- Modèle Ackermann-Jeantand (géométrique)

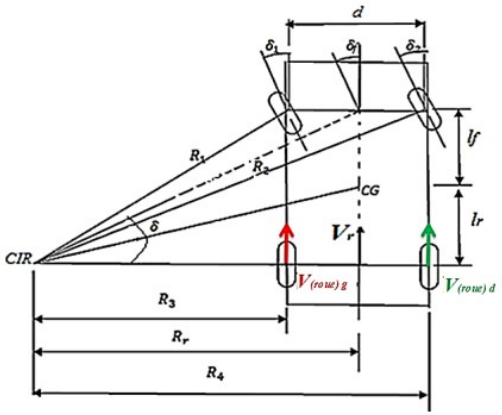


Figure 2. 10 : Modèle d'une trajectoire courbée **[29]**

D'où :

$$V_{(roue)g} = V - \left(\frac{\tan(\delta).d/2}{L}\right)V \qquad (2.53)$$

$$V_{(roue)d} = V + \left(\frac{\tan(\delta).d/2}{L}\right)V \qquad (2.54)$$

http://dspace1.univ-tlemcen.dz/bitstream/112/13696/1/Doct.Aut.BENARIBA.pdf

3- Modèles existants - Véhicule

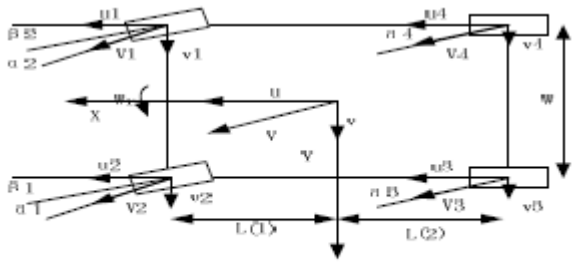


Fig. 1. The speed model of the steering of EV

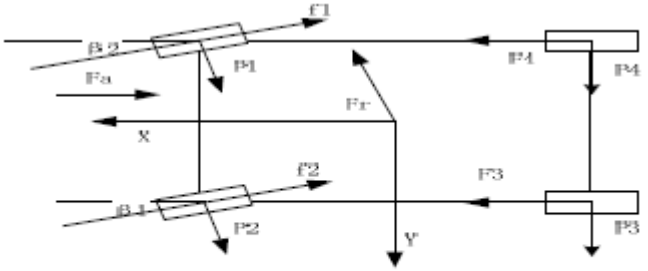


Fig. 3. The force model of the steering EV

$$Fx1=-f1*\cos\beta1-P1*\sin\beta1 .$$

$$Fx2=-f2*\cos\beta2-P1*\sin\beta2 .$$

$$Fy1=P1*\cos\beta1-f1*\sin\beta1 .$$

$$Fy2=P2*\cos\beta2-f1*\sin\beta2 .$$

$$Fx1+Fx2+F3+F4+M*v*Wr=M*\dot{u} \quad .$$

$$Fy1+Fy2+P3+P4-M*u*Wr=M*\dot{v} \quad .$$

$$(Fy1+Fy2)*L(1)+\frac{(Fx2+F4-Fx1-F2)*W}{2} \quad -(P3+P4)*L(2)=Iz*\frac{dWr}{dt}$$

$$\begin{cases} u1=u-Wr*W/2 \\ u2=u+Wr*W/2 \\ u3=u-Wr*W/2 \\ u4=u+Wr*W/2 \end{cases}, \begin{cases} v1=v+Wr*L(1) \\ v2=v+Wr*L(1) \\ v3=v-Wr*L(2) \\ v4=v-Wr*L(2) \end{cases}$$

$$S=1-\frac{uw}{\omega R}$$

$$Te-Mr-F*R=\frac{d\omega}{dt}$$

Research on Electric Differential for Steering Electric Vehicles
Zitong Wang, Wei Yao, and Wei Zhang

3- Modèles existants - Pneus

The « Magic Formula » by Pacejka

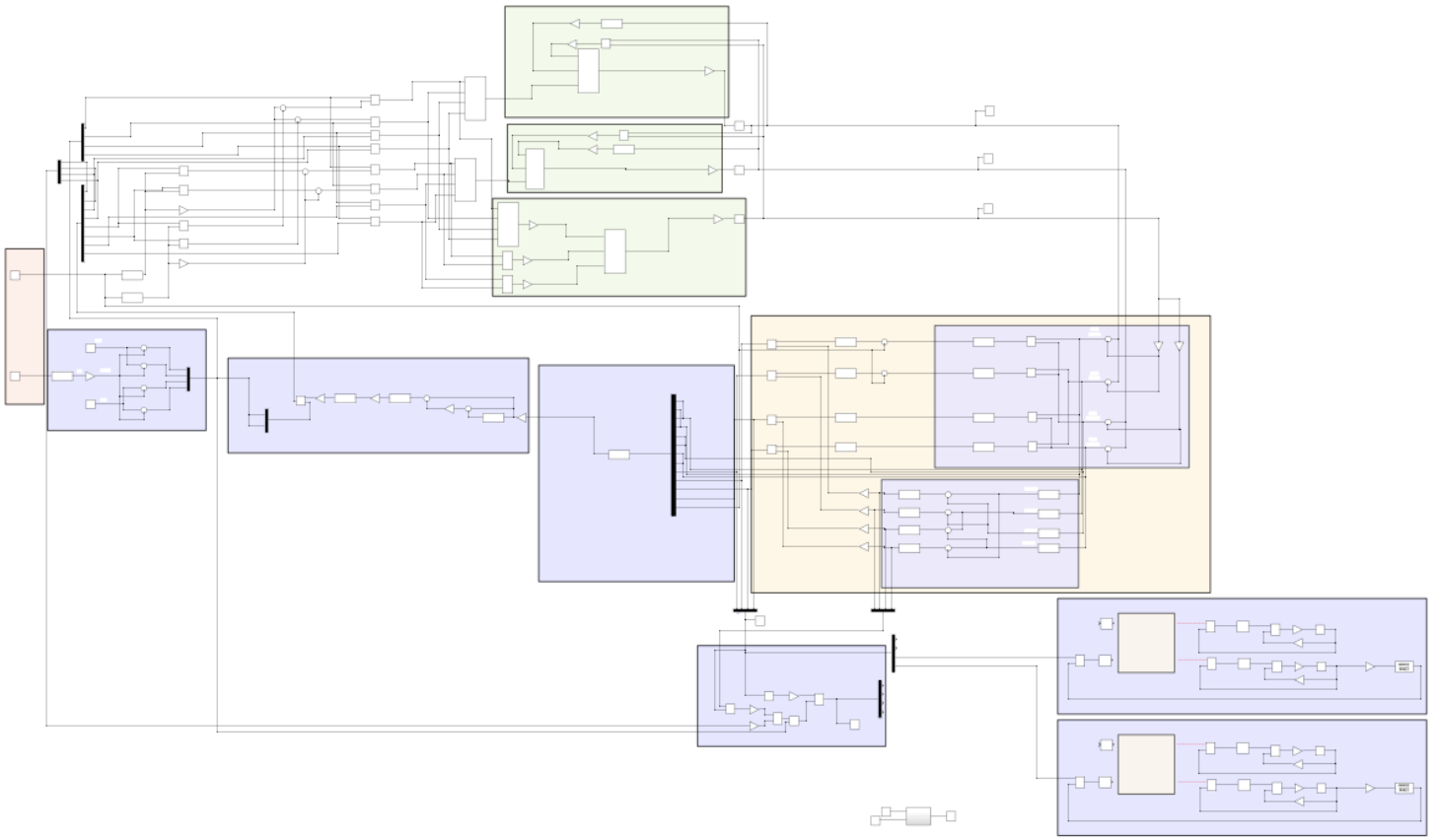
Equation (1) shows the general equation of the Magic Formula tire model [1].

$$F(x) = D\cos(C\arctan(Bx - E(Bx - \arctan(Bx)))) \quad (1)$$

F(x) in the equation is either the longitudinal force F_x with x being represented by the longitudinal slip ϰ, or the lateral force F_y with x being represented by the lateral slip α. The coefficients B, C, D, and E define the characteristics of the curve and are calculated with additional equations using parameters found in the tire data files.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9071136

4) Avancement modèle Simulink



5) Questionnements techniques

- Implémentation à quel endroit ? Dans le VCU ? Si oui quelle puissance de calcul est nécessaire ?

- Quelle limite à l’autre extrémité ? Envoyer un consigne de couple à chaque onduleur ? Un consigne de courant ? Sous quelle forme ?

- A quelles questions doit-on se limiter dans le cadre de ce stage ?

- Comment définir des critères de stabilité, précision, rapidité,... pour une commande de commande ?