

**부산대학교**  
**차량 동역학 및 에너지 제어 연구실**  
Since 2013



# Research Areas



Autonomous  
Vehicle

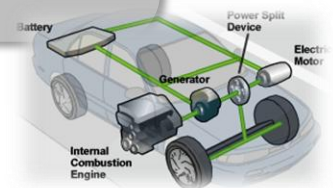


Vehicle Dynamics  
and Control

최적 제어,  
추정,  
센서 융합,  
인공 지능

EV  
열관리시스템  
제어

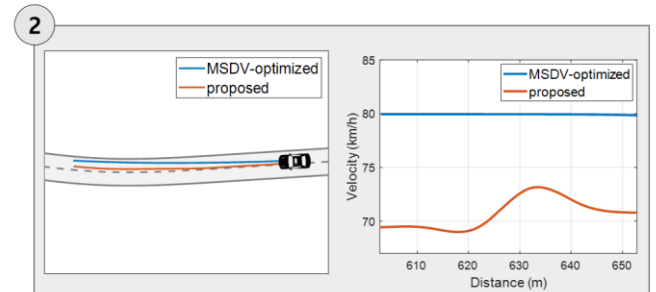
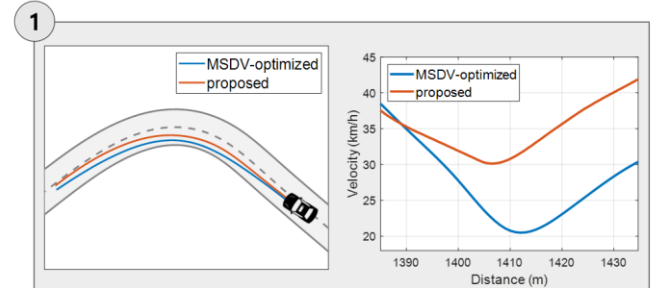
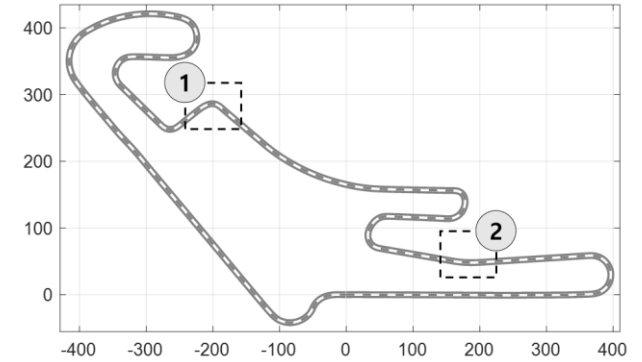
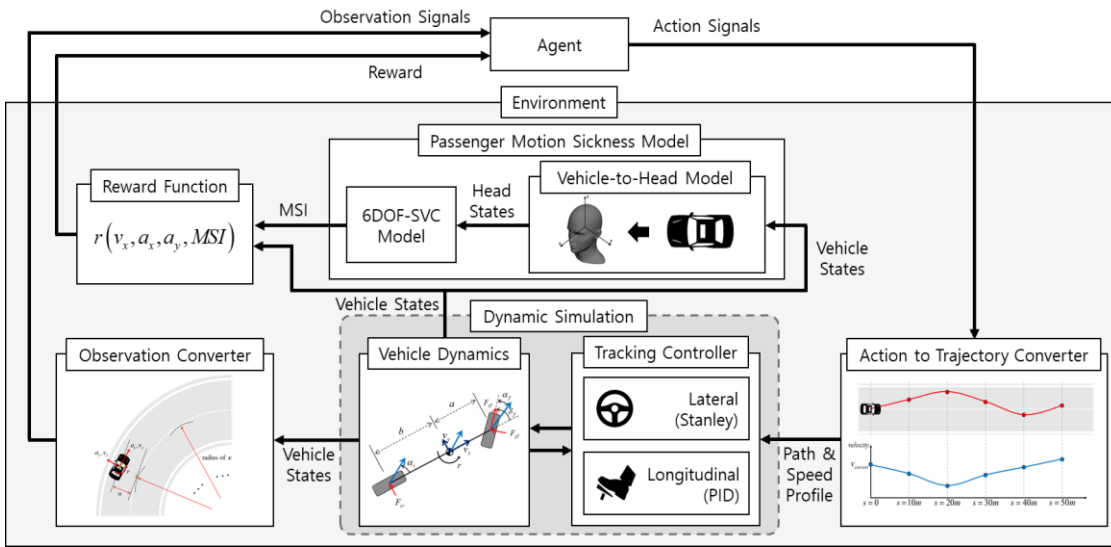
HEV  
동력시스템 제어



# AUTONOMOUS VEHICLE

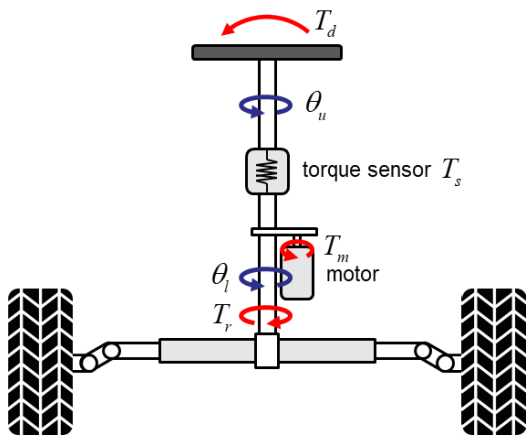
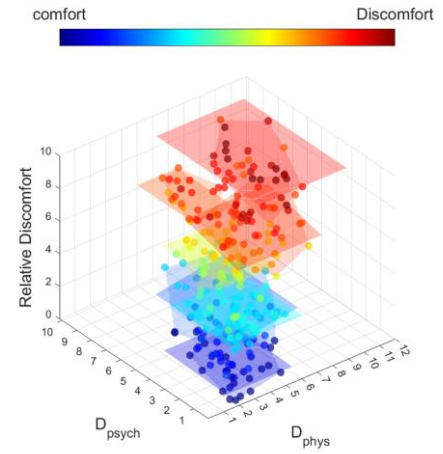
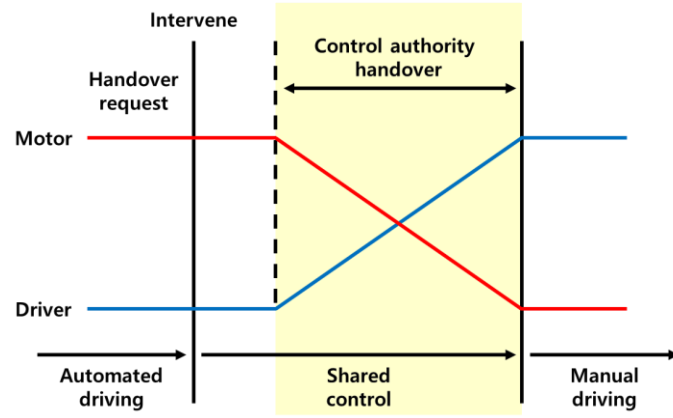
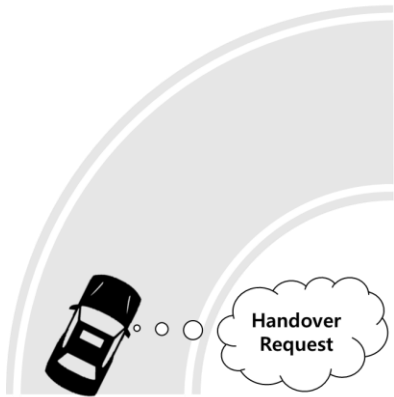


# 자율주행차용 RL 기반 멀미저감 주행 알고리즘

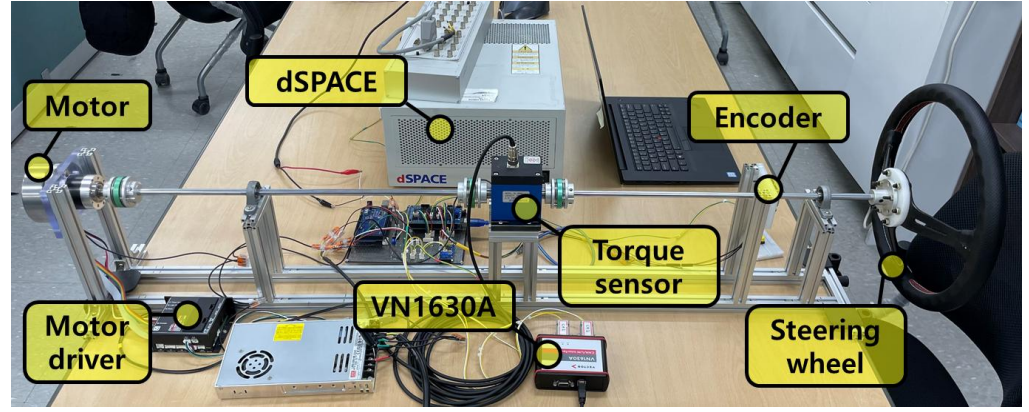


# 불편함 저감 자율주행 제어권 이양 알고리즘

- Discomfort Quantification

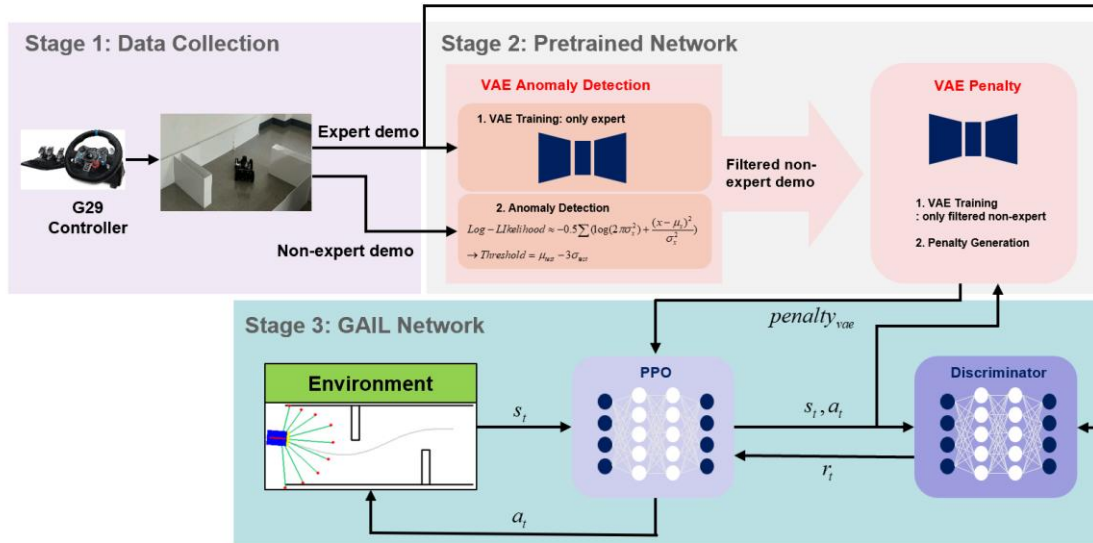


HILS Implementation

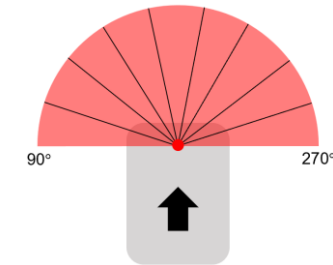


# 전문가-비전문가 데이터 기반 생성형 모방학습을 활용한 자율주행차 제어기 설계

## - Framework

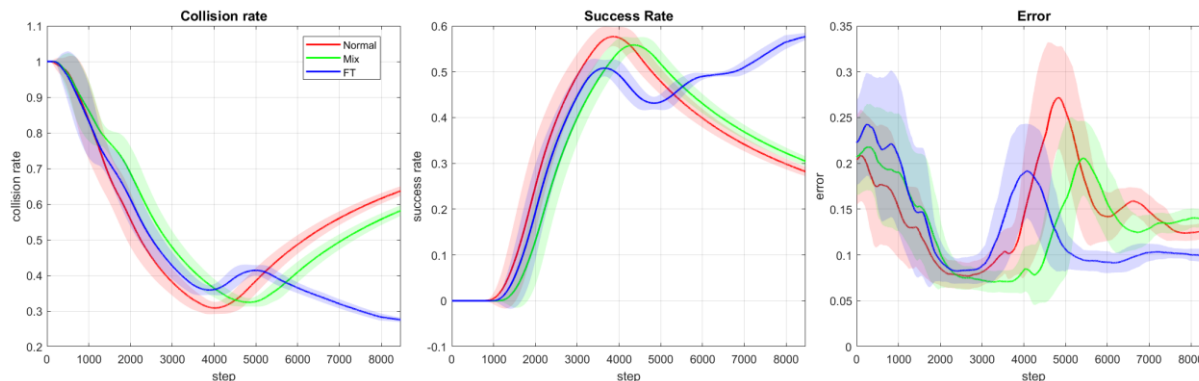


## 1. Observation : LiDAR Data



## 2. Action : Throttle & Steering

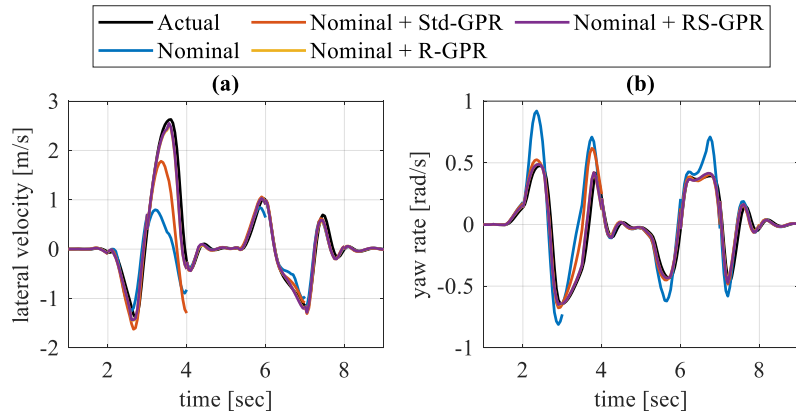
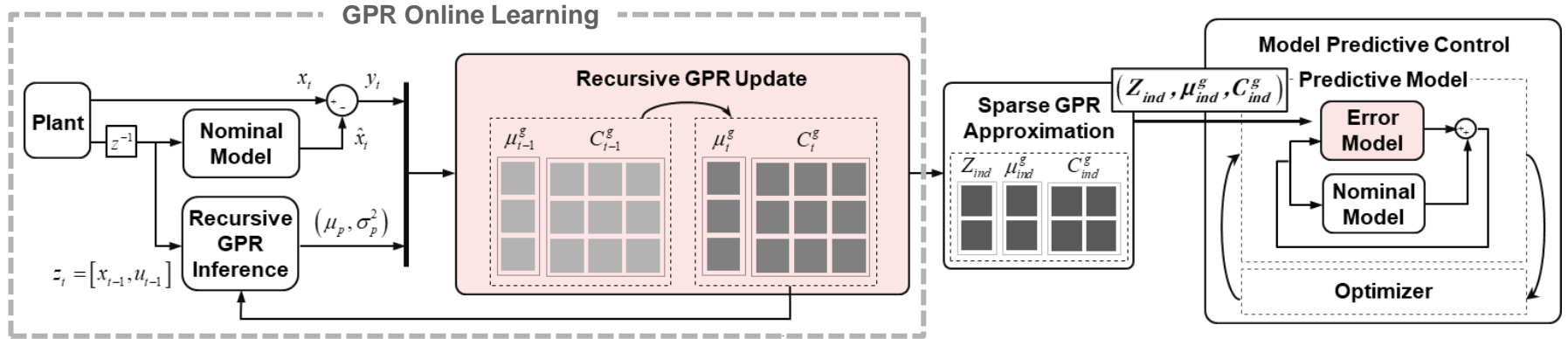
## - Training Result



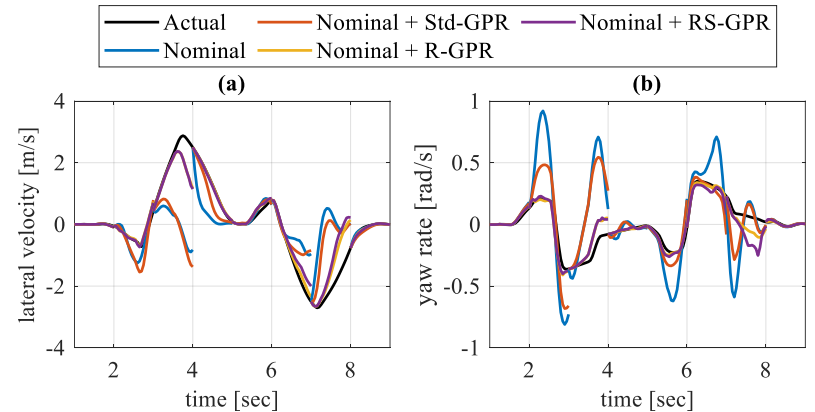
# DYNAMICS



# GPR 기반 MPC 적용을 위한 제어 지향 모델

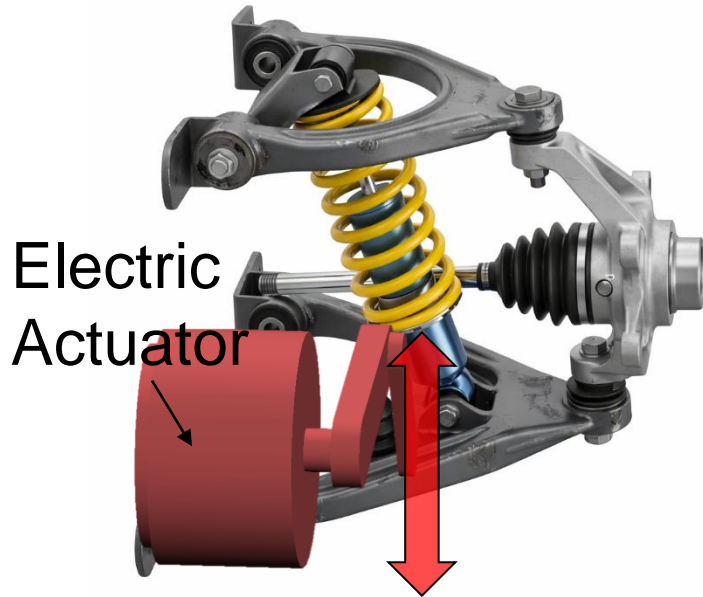


Trained and tested under high-friction road condition



Trained under high-friction road condition and tested under low-friction road condition

# Electric Actuator-Based Damping Control

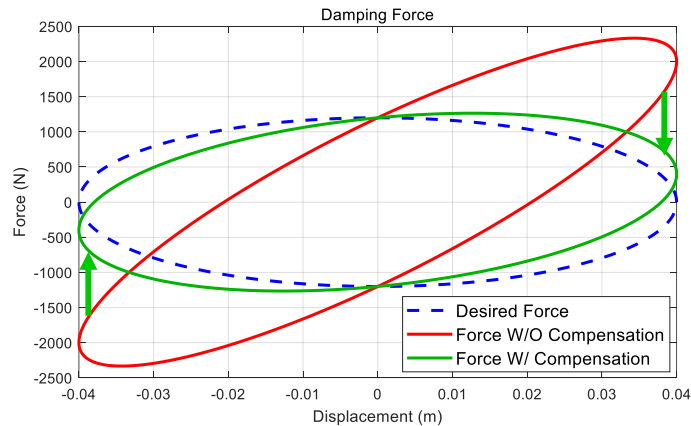
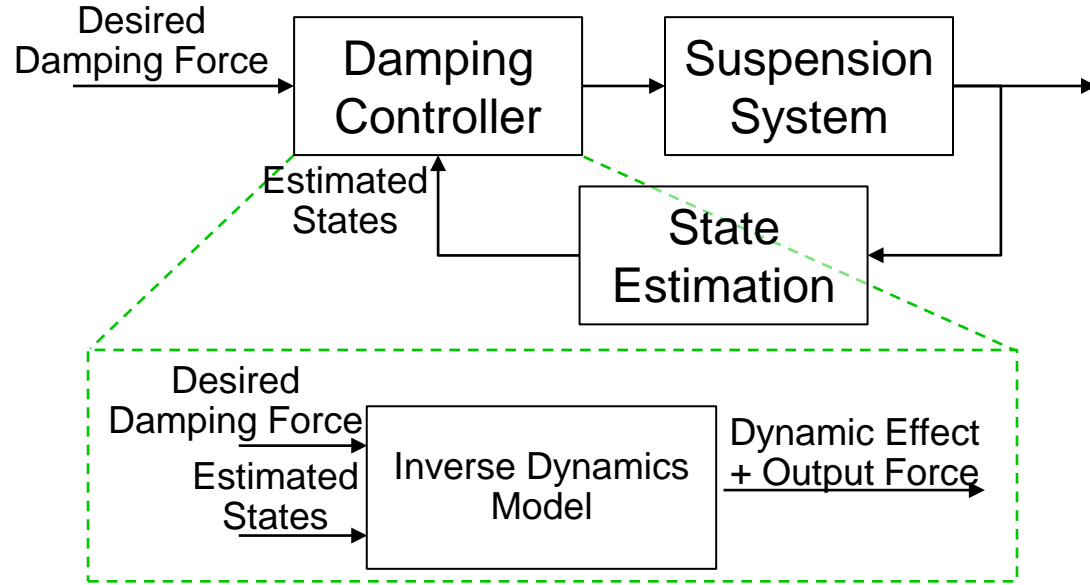


**Actuator Force** = **Dynamic Effects** + **Transmitted force** + **Output Force**

Dynamic Effects:

- Disturb the output force (transmitted force)
- Include inertia, friction and other effects

→ **Compensation required for damping control**

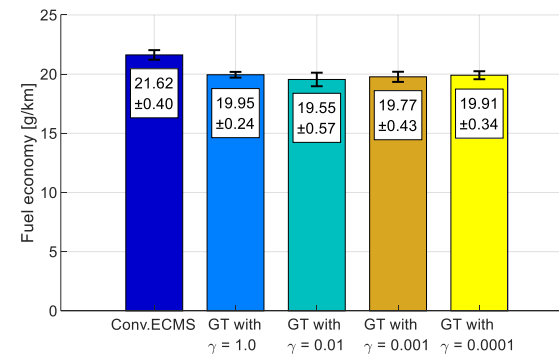
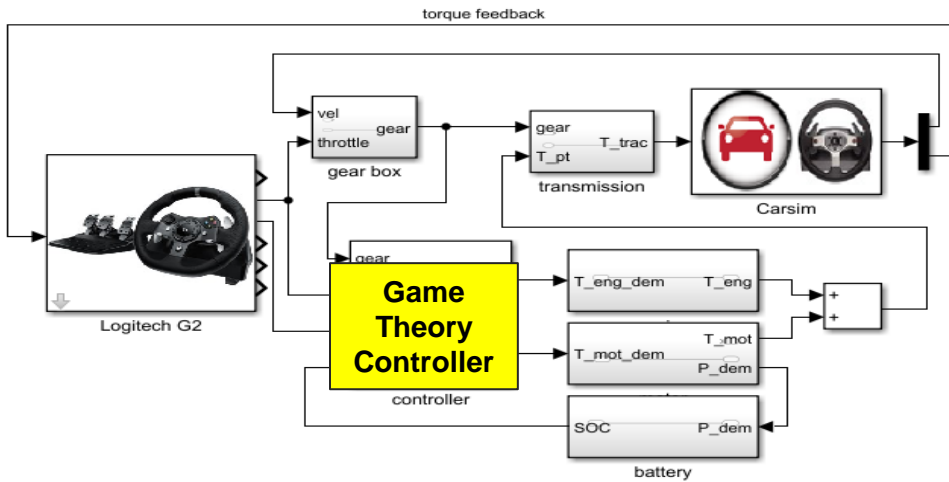
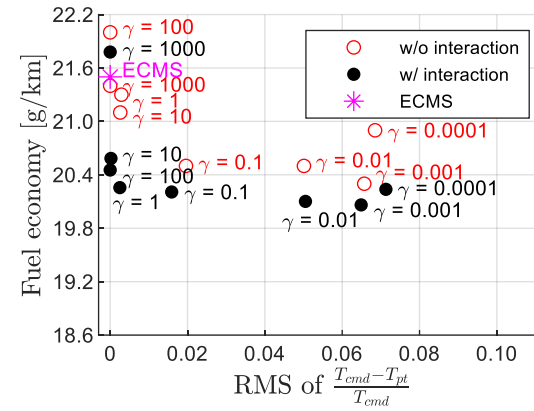


Compensation

# HYBRID ELECTRIC VEHICLE 동력 시스템 제어



# HEV Power Management Controller

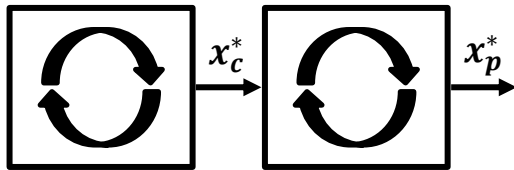


# ELECTRIC VEHICLE 열관리시스템 제어

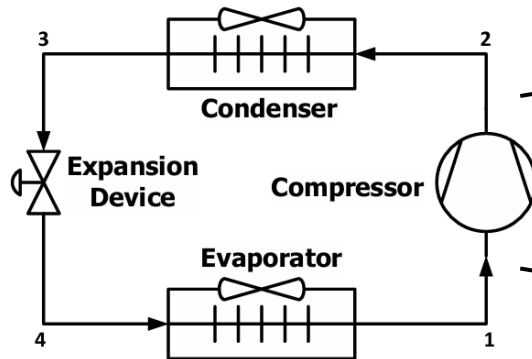
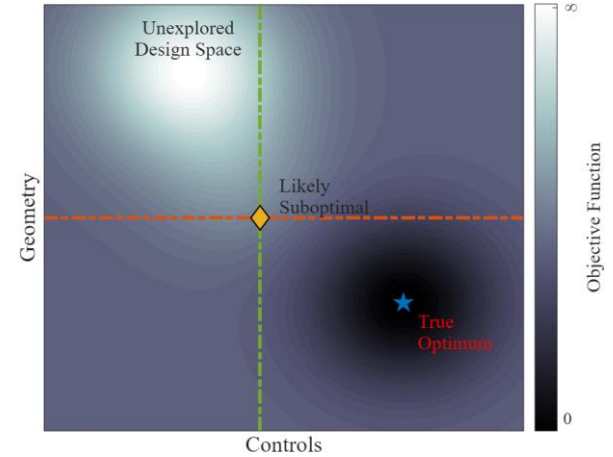
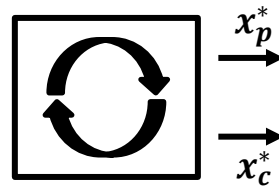


# Control Co-Design of Vehicle Thermal System

Traditional: Sequential Design  
(Plant Design → Controller)



Proposed: Control Co-Design  
(Simultaneous Design  
of Plant and Controller)



Parameter  
Optimization

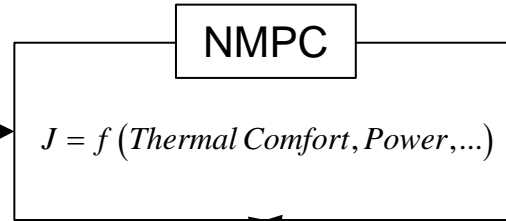
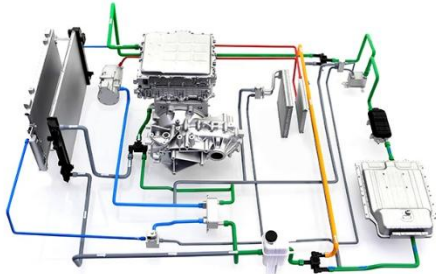
Compressor

Heat Exchanger

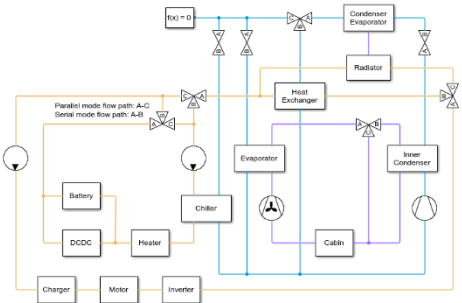
Expansion Valve

# 열쾌적감 기반 EV 히트펌프 MPC 제어

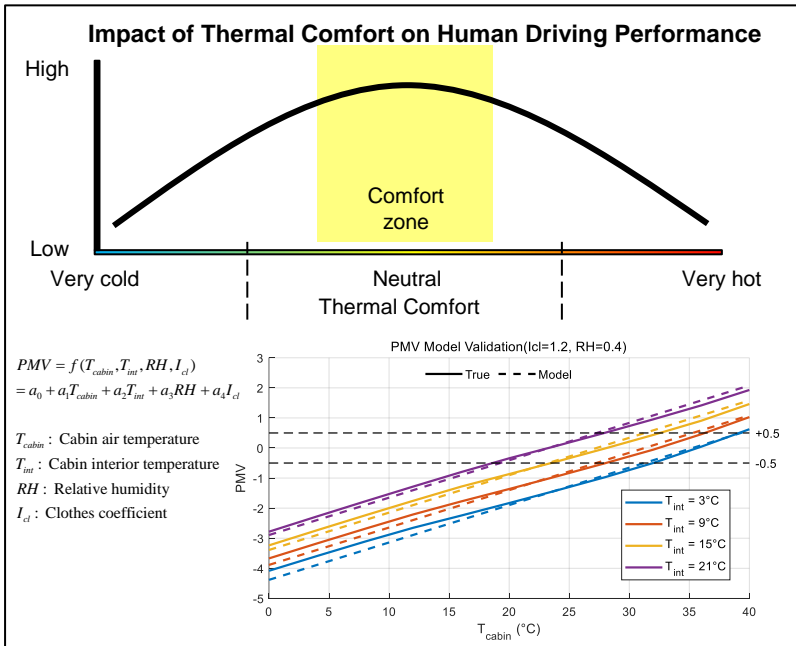
## EV Thermal Management System



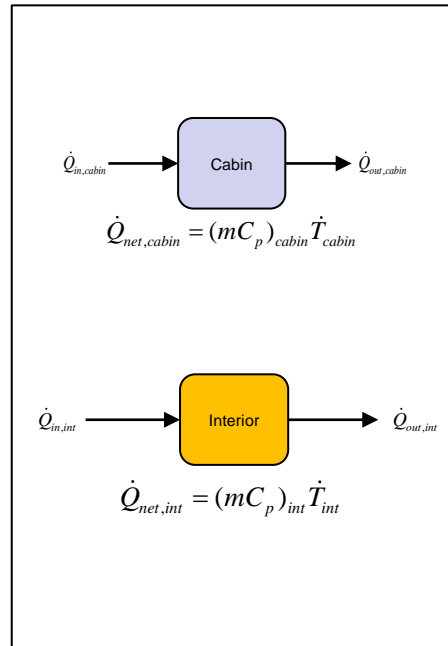
## TMS Simulation



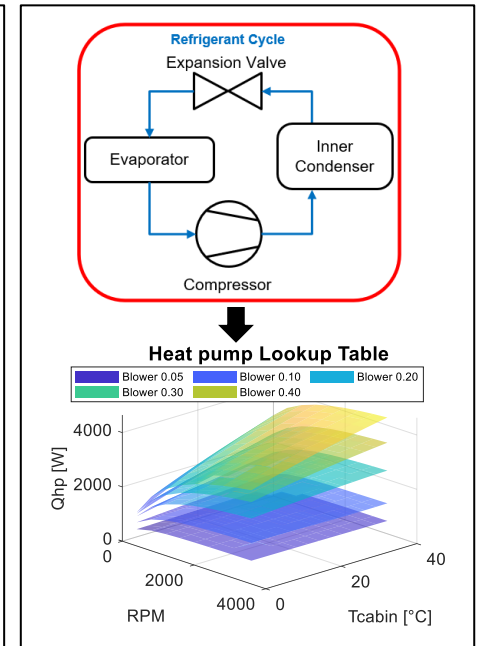
### Thermal comfort model



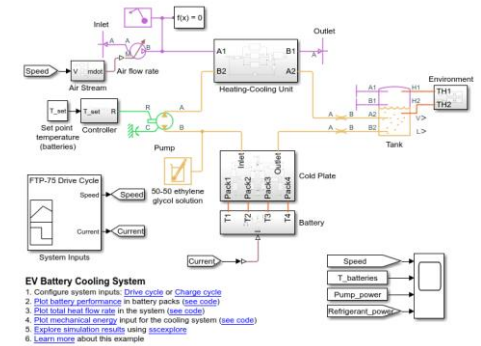
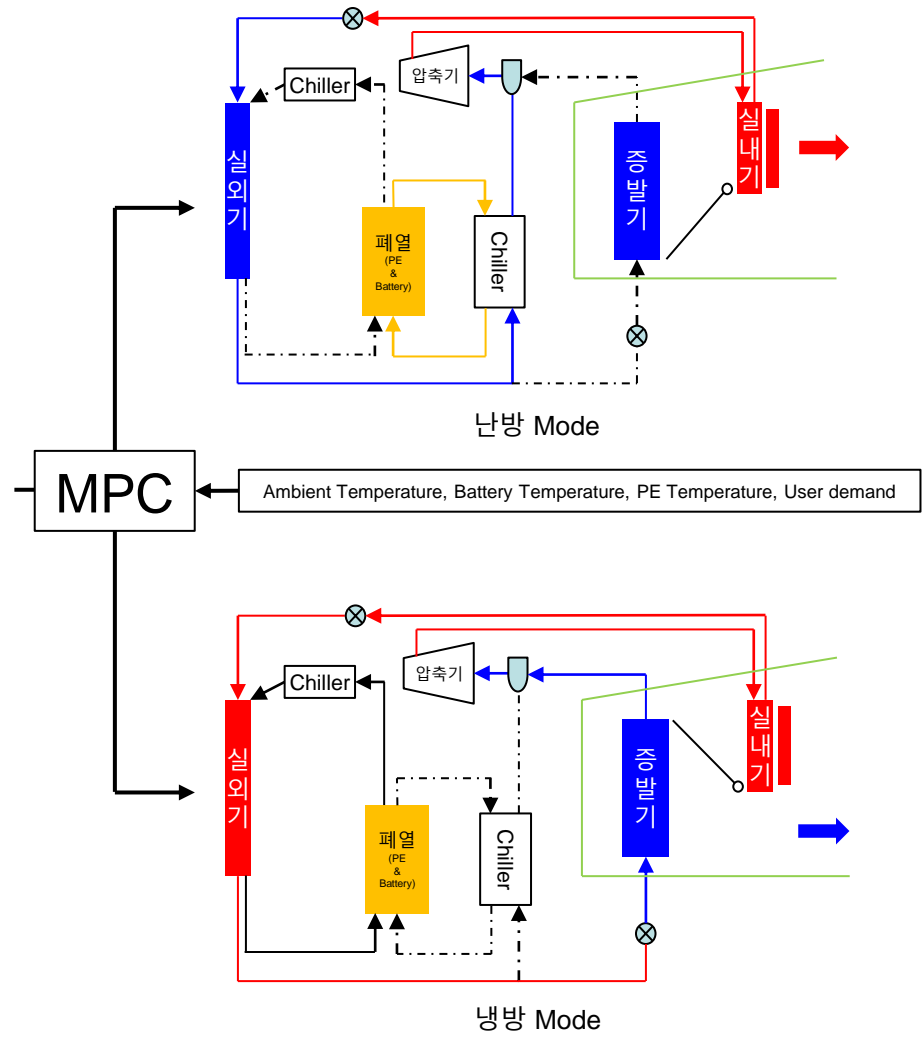
### Thermal dynamics model



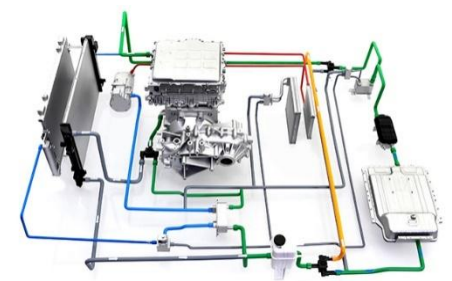
### Heat pump system model



# MPC 기반 전기차 통합열관리 제어



simulation

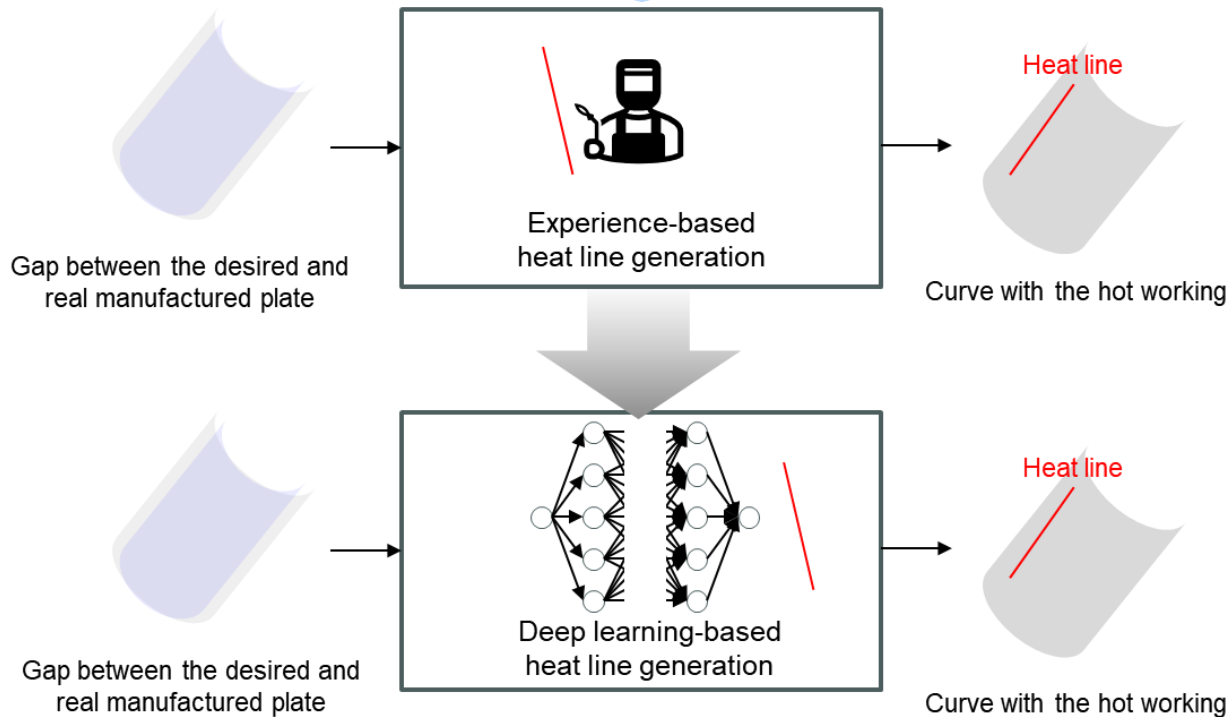
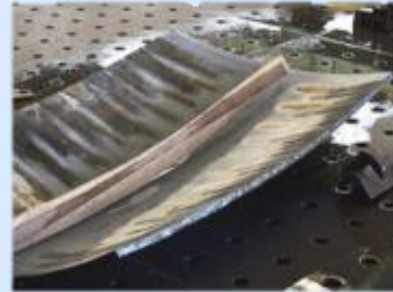


hardware

# 기타 제어 시스템



# AI기반 곡가공 가열선 자동 생성 연구



# 연구실 향후 진로



# 졸업 후 진로

교수 1명 (창원대)

해외 유학 1명 (PennState)

|         |   |    |  |    |
|---------|---|----|--|----|
| 정부출연연구소 | <br>한국항공우주연구원                | 1명 | <br>국방과학연구소<br>Agency for Defense Development | 1명 |
| 기업      | <br>HYUNDAI                  | 4명 | <br>HYUNDAI<br>MOBIS                          | 3명 |
|         |  LG 에너지솔루션                   | 2명 | <br>HD HYUNDAI<br>HEAVY INDUSTRIES            | 1명 |
|         | <br>Mando<br>Halla Company | 1명 | <br>erae                                    | 1명 |
|         |  한화에어로스페이스                 | 1명 | <br>HANKOOK<br>driving emotion              | 1명 |