

# 3.1 MBD

Model Based Development

## ✓ 高度なMBD技術により“試作レス開発”を実現し、車両開発の効率化に貢献

Advanced MBD technology achieves “prototype-less development”, and contributes to high efficiency of vehicle development

### 要求分析 Request Analysis

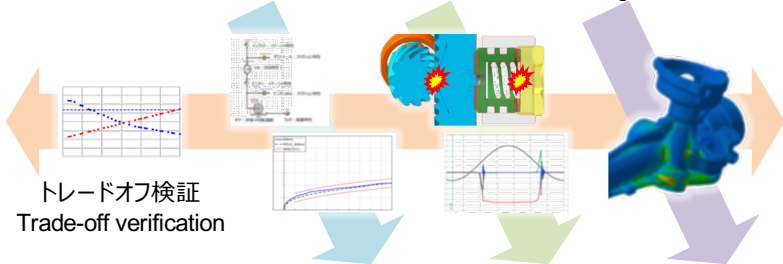


OEM要求 / 自社目標設定  
OEM request / Own company target setting

### 早期仕様確立が可能な高精度CAE技術

High precision CAE technology that can quickly determine design specifications

性能 Performance  
音・振動 NV  
強度 Strength



トレードオフ検証  
Trade-off verification

MBD環境  
MBD environment

車両設計  
Vehicle design

システム設計  
System design

部品設計  
Parts design

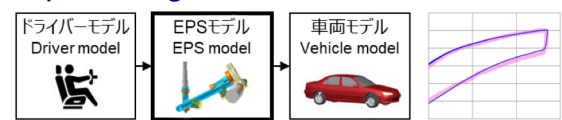
システム評価  
System verification

部品評価  
Parts verification

試作品廃止  
Abolition of prototype

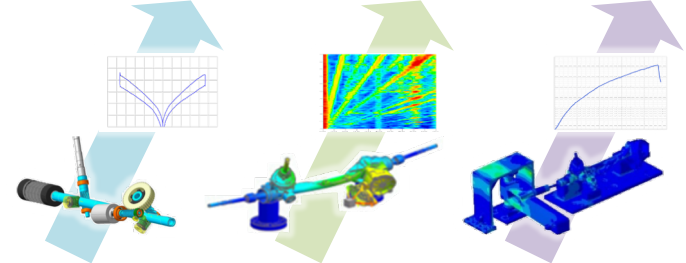
車両評価  
Vehicle verification

車両特性を予測可能な高精度EPSモデル  
High precision EPS model for predicting vehicle characteristics



試作テスト廃止が可能な高精度CAE技術  
High precision CAE technology that can abolish design verification test

性能 Performance  
音・振動 NV  
強度 Strength



### モデル化の課題となっていたEPS領域をモデル化し、高精度シミュレーション評価を実現

Modeling the EPS field which has become the problem of modeling, and realize verification by high precision simulation

## 3.2 MBDの特長

Features of MBD

### ✓ 車両特性を予測可能な高精度EPSモデル

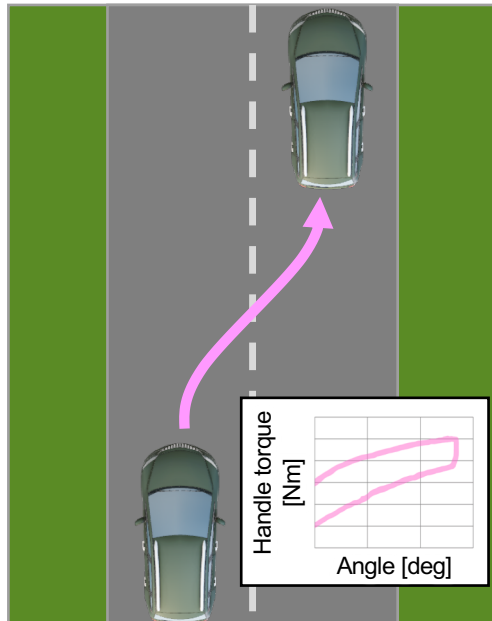
High precision EPS model for predicting vehicle characteristics

### ■ 高精度EPSモデル化：“実機の車両特性”を高精度で予測可能

High precision EPS Modeling : Can predict vehicle characteristics with high precision

<車両特性>

Vehicle characteristics



Astemo

<MBD技術>

MBD technology

【従来課題 Conventional Challenges】

**EPSモデルによる車両特性予測は困難**

Prediction of vehicle characteristics using EPS model is difficult

**実機のEPSを用いてHILSで検証**

Verify with HILS using the real EPS



HILS (Hardware In the Loop Simulation)

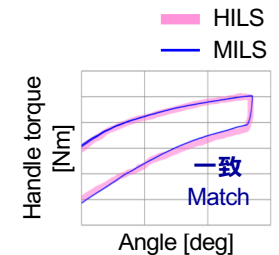
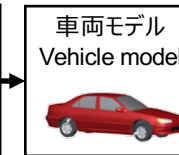
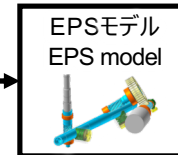
【自社技術 Own technology】

**EPSモデルの細部再現による高精度化**

High precision by reproducing details of EPS model

**MILSでHILS同等の車両特性予測が可能**

Prediction of vehicle characteristics equivalent to HILS is possible using MILS



MILS (Model In the Loop Simulation)

# 3.3 MBDの特長

## Features of MBD

✓ **車両特性を予測可能な高精度EPSモデル**  
High precision EPS model for predicting vehicle characteristics

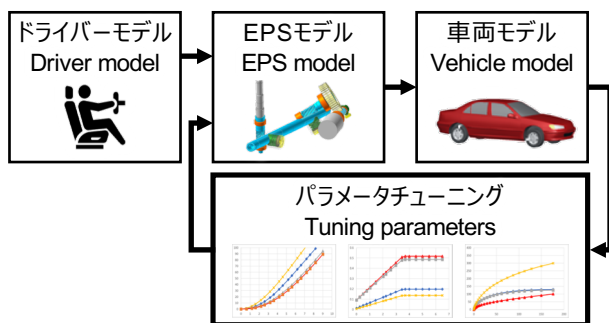
IDAJ Conference Online 2021  
発表内容

■ **制御MAPの自動最適化：“目標の車両特性”を高精度／短時間で適合可能**

Automatic optimization of Control MAP : The vehicle characteristics of target can be adapted in a short time and high precision

<従来の制御MAPチューニングと課題>

Conventional control MAP tuning and challenges

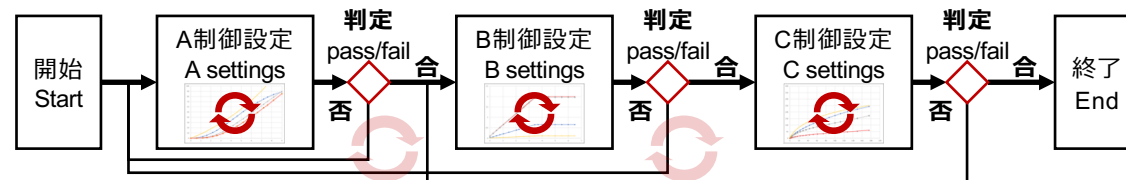


数百のパラメーターを人がノウハウを活用して設定  
Human set up many parameters using know-how

**Astemo**

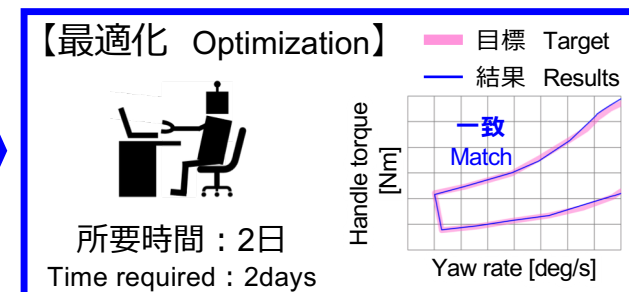
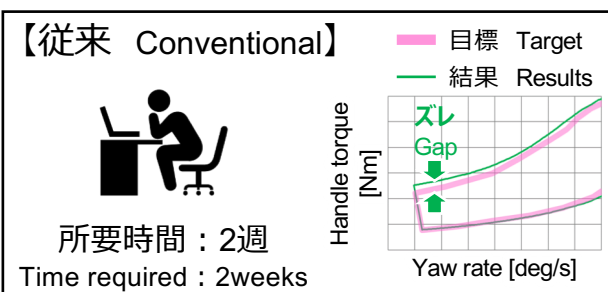
<自動最適化と効果>

Automatic optimization and effects



人がチューニングするプロセスと同等の自動最適化ワークフローを構築

Build an automatic optimization workflow that is equivalent to a human-tuned process



目標特性同等となる制御MAPの自動最適セッティングが可能

Automatic optimal setting of control MAP which is the same as the target is possible

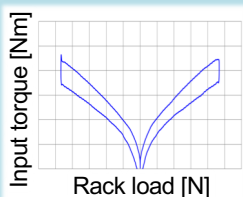
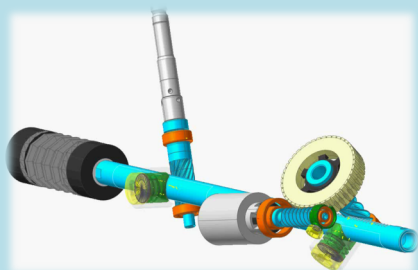
# 3.4 MBDの特長

## Features of MBD

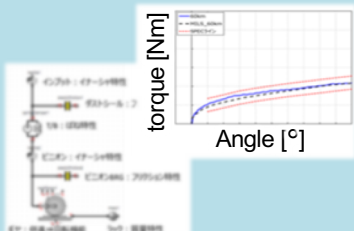
### ✓ EPS領域における高精度CAE技術

High precision CAE technology in EPS

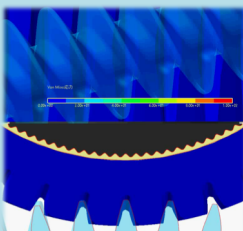
#### <性能 Performance>



入出力特性 Input/Output characteristics

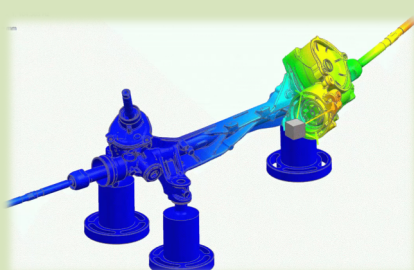


切り始め特性  
Turning start characteristics

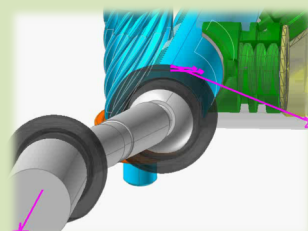
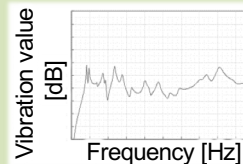
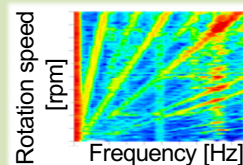


ギヤ噛合挙動  
Gear behavior

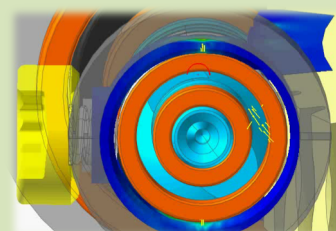
#### <音・振動 NV>



作動音 Operation noise

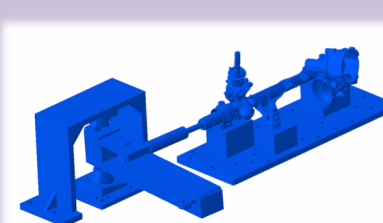


ラック打音  
Rack rattle noise

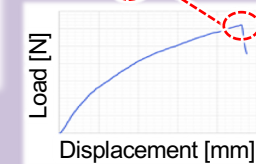
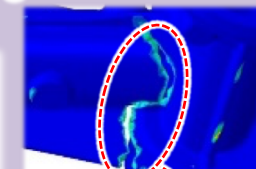


ウォーム打音  
Worm rattle noise

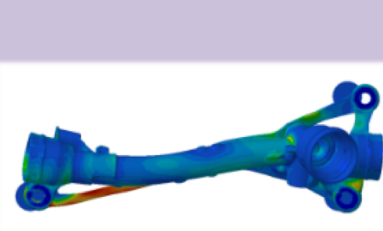
#### <強度 Strength>



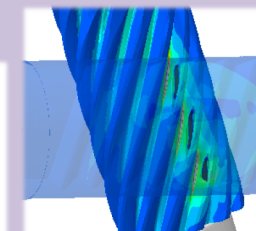
静的強度  
Static strength



ギヤ強度  
Gear strength



トポロジー最適化  
Topology optimization



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