

# 2モータトルク差増幅型トルクベクタリング装置

## Two Motor Torque Differential Amplification Type TVD\*

\*: Torque Vectoring Differential

### ○研究試作品

従来の左右駆動力配分装置と比べて、シンプルで軽量・コンパクト、かつ優れたトルク配分能力を持つ2モータトルク差増幅型トルクベクタリング装置により、寒冷地走行等に適した安心・快適な走行性能を実現します。

### 1 2モータトルク差増幅型TVDの原理・構造

#### ○コンセプト

$$\Delta T \equiv (T_R - T_L) = \alpha \cdot (T_{M2} - T_{M1})$$

#### ○トルク差増幅性能を決定する重要なパラメータ

$$\alpha = \frac{2a + b}{b} = \frac{Z_{RG}}{Z_{RG} - 2Z_{SG}}$$

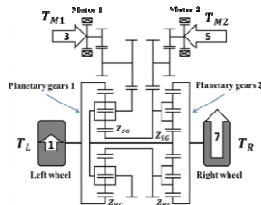


Fig.1 Schematic figure of two electric motor torque difference amplification system (e.g. Z<sub>RG</sub>=81, Z<sub>SG</sub>=27, α=3)

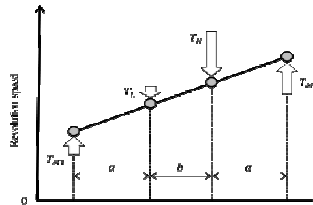


Fig.2 Velocity diagram of two electric motor torque difference amplification mechanism

### 2 他方式とのヨーモーメント発生能力の比較

#### ○想定車両

Table 1 Vehicle Specifications

Vehicle		
Front Vehicle Mass	750	[kg]
Rear Vehicle Mass	750	[kg]
Total Mass	1500	[kg]
Wheel Base	2.500	[m]
Height of Center of Gravity	0.500	[m]
Front Track	1.500	[m]
Rear Track	1.500	[m]
Front Vehicle Roll Stiffness	50000	[Nm/rad]
Rear Vehicle Roll Stiffness	50000	[Nm/rad]
Height of Front Roll Center	0.050	[m]
Height of Rear Roll Center	0.100	[m]
Tire Radius	0.320	[m]
Air resistance coefficient	0.3	[-]
Frontal projected area	2.5	[m <sup>2</sup> ]
Rolling resistance coefficient	0.01	[-]
Air density	1.2	[kg/m <sup>3</sup> ]
Motor (Total performance)		
Rated power	60	[kw]
Maximum power	100	[kw]
Maximum torque	400(0-2500rpm)	[Nm]
Maximum revolutions	10000	[rpm]
Reduction ratio	6	[-]
Drive system	Rear-wheel drive	[-]

### ○具備すべきヨーモーメント発生能力 (最大トルク差)

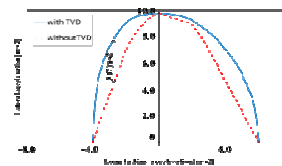


Fig.3 Vehicle dynamics potential

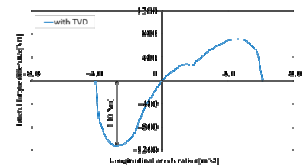
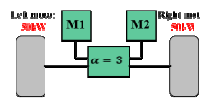


Fig.4 Torque difference of TVD

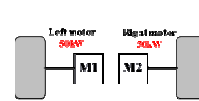
### ○電動乗用車用の各種TVD方式



$$T = T_{M1} + T_{M2}$$

$$\Delta T = 3(T_{M2} - T_{M1})$$

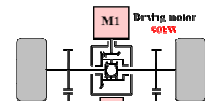
Fig.5 TDA (e.g. α=3)  
2モータトルク差増幅型



$$T = T_{M1} + T_{M2}$$

$$\Delta T = T_{M2} - T_{M1}$$

Fig.6 IMD  
左右独立型



$$T = T_{M1}$$

$$\Delta T = T_{M2}$$

Fig.7 LTA  
トルク差付加型

### ○比較結果

#### Torque Distribution Potential (TDP)

- 横軸に左右輪間トルク差、縦軸に左右輪の総トルクをとった時の各方式の総駆動力配分範囲を40[km/h]、120[km/h]走行時で比較
- 2モータトルク差付加型が優れる

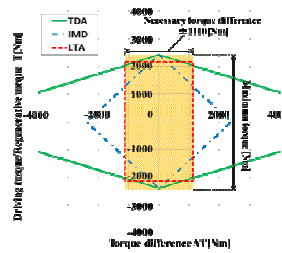


Fig.8 TDP of 40[km/h]

Table 2 TDP points of 40[km/h]

TVD type	TDP points
TDA	92.3%
IMD	76.9%
LTA	90.0%

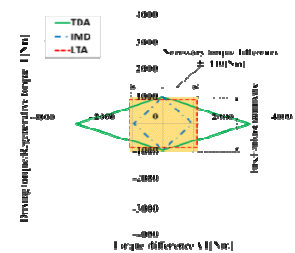


Fig.9 TDP of 120[km/h]

Table 3 TDP points of 120[km/h]

TVD type	TDP points
TDA	80.6%
IMD	43.0%
LTA	90.0%



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