Automotive Chassis-by-Wire Industry Report, 2020

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STUDY GOAL AND OBJECTIVES

This report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs.

REPORT OBJECTIVES

- To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts.
- To assist potential market entrants in evaluating prospective acquisition and joint venture candidates.
- To complement the organizations' internal competitor information gathering efforts with strategic analysis, data interpretation and insight.
- To suggest for concerned investors in line with the current development of this industry as well as the development tendency.
- To help company to succeed in a competitive market, and

METHODOLOGY

Both primary and secondary research methodologies were used in preparing this study. Initially, a comprehensive and exhaustive search of the literature on this industry was conducted. These sources included related books and journals, trade literature, marketing literature, other product/promotional literature, annual reports, security analyst reports, and other publications. Subsequently, telephone interviews or email correspondence was conducted with marketing executives etc. Other sources included related magazines, academics, and consulting companies.

INFORMATION SOURCES

The primary information sources include Company Reports, and National Bureau of Statistics of China etc.

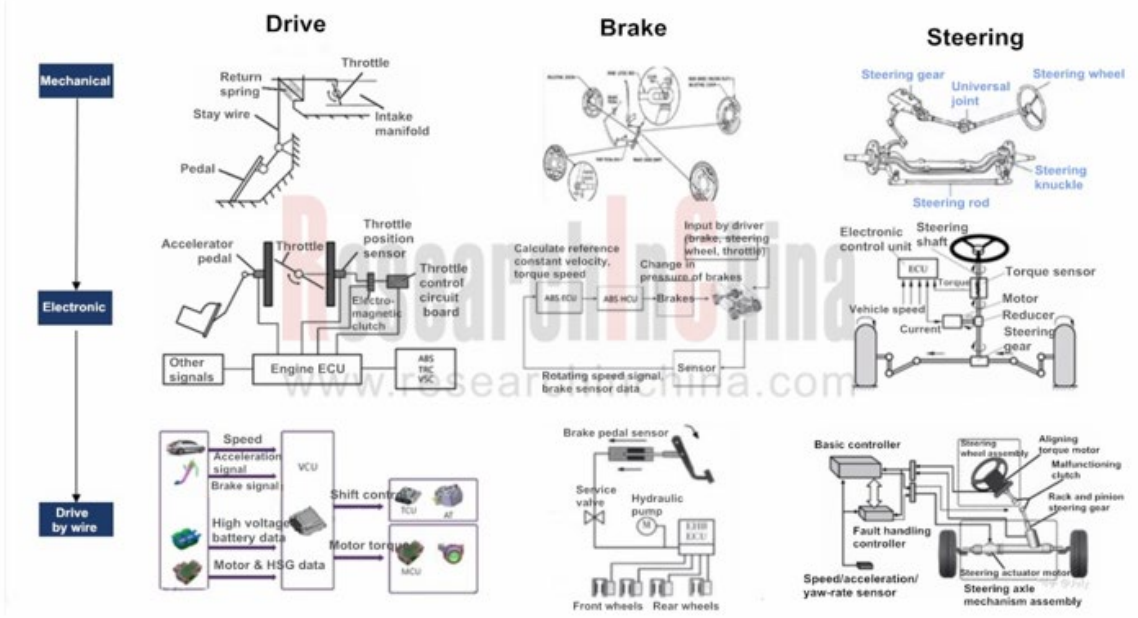
Abstract

Launch of Autonomous Driving Remains to Use Mature Chassis-by-wire Technology

Chassis-by-wire makes it feasible to remove accelerator pedal, brake pedal and steering wheel, whose maturity has a bearing on autonomous driving implementations.

Critical elements of chassis by wire include: throttle by wire, gear shift by wire, suspension by wire, steering by wire and brake by wire. Wherein, drive, brake and steering are deemed as the crucial factors to vehicle travel.

Development History of Drive, Brake and Steering



Throttle by wire has been the first option for passenger cars, especially ACC/TCS-enabled vehicles for which such throttle has been a standard configuration. Promotion of drive by wire and steering by wire has suffered a setback due to a combination of factors such as poor user experience than conventional mechanical system for early immature technology, and difficulty in sorting out who is responsible, a result that drive by wire technology refers to regulation and control on the actuator by ECU. In recent years, boom of intelligent connected vehicles has invigorated drive-by-wire technology.

Development History of Automotive Brake

	Time	Key Products	Status Quo	Function
Hydraulic +ECU	1930	Brake master cylinder, vacuum booster	Disc brake	Hardware foundation for brake
Electronic + Drive by wire	1980-2000	ABS, ESP	ABS as a standard configuration, ESP for mainstream use	• Fusion with ECU • Software foundation for safety technology
Drive by wire	2010-	EHB, EMB	EHB: current direction EMB: future trend	• Wires replace some of brake circuits and transmission mechanism • Key configuration that promotes electrification and automated driving

Brake by wire: Bosch, Continental and ZF leads the pack, while Chinese companies like Bethel Automotive Safety Systems Co., Ltd., Shanghai NASN Automotive Electronics Co., Ltd. and Ningbo Tuopu Group are chasing hard.

Over a century, automotive brake system has evolved from the mechanical to the hydraulic and then to the electronic (ABS/ESC). For L3 autonomy and above, responsive time of brake system is of paramount importance. Faster response of brake by wire ensures safe autonomous driving.

Brake-by-wire system is bifurcated into two types: Electro Hydraulic Brake (EHB) and Electro Mechanical Brake (EMB). EHB is split into One-Box and Two-Box solutions based on whether it is integrated with ABS/ESP or not.

One-box solution already prevails:
•One-box solution with fusion of ESP into EHB is based on mass production of mature ESP. Considering performance and cost, Bosch, Continental and ZF are doubling down on One-box products.
•Chinese suppliers with first-mover advantage are expected to replace foreign brands. Bethel Automotive Safety Systems Co., Ltd., the first to have developed One-box products in China, plans to spawn WCBS products in 2020, close to the SOP time of its foreign peers like Bosch. Its WCBS integrated with dual control EPB is more cost-effective.

One-Box Solution Vs. Two-Box Solution

	One-Box	Two-Box
Definition	Integrated type: EHB integrated with ABS/ESP	Discrete type: EHB independent of ABS/ESP
Structure	1 ECU + 1 brake unit (ECU incorporating capabilities like ESP)	2 ECUs + 2 brake units (need for coordination between EHB ECU and ESP ECU)
Cost	High integration, lower cost	Low integration, higher cost
Complexity and safety	High, need for modified pedal (pedal decoupling) Sensor is used to know the strength of the pedal which is only for inputting signals rather than working on the master cylinder, and to drive the motor to push the piston, which may bring about hidden dangers since the pedal requires to be adjusted by software.	Low, no need for modified pedal (pedal coupling) The driver feels the pedal so clearly and naturally that he can know the change of brake system intuitively, and force-feedback ABS senses the recession of brake pad to reduce potential safety risks.
Energy recovery	Higher recovery efficiency, regenerative braking deceleration: up to 0.3g-0.5g	High recovery efficiency, regenerative braking deceleration: up to 0.3g
Autonomous driving	Offer enough redundancy for autonomous driving	Offer enough redundancy for autonomous driving when working with ESP

Chinese and Foreign Brake-by-Wire Products

Manufacturer	Product	Type	Start of Production	Supporting
Bosch	iBooster	Two-box	2013	Porsche 918, SAIC Volkswagen new energy products, GM Volt, full range of Tesla, Roewe Marvel X, Roewe Ei5, Leading Ideal ONE, Lynk & Co 01/03 PHEV, full range of NIO, Xpeng P7/G3, etc.
	IPB	One-box	2020	BYD Han, Cadillac XT4
Continental	MK C1	One-box	2016	Alfa Romeo Giulia, Audi e-tron, BMW X5/X7
	EBB	Two-box	-	-
ZF	IBC	One-box	2018	GM K2XX Platform
Schaeffler	SPACE DRIVE	One-box	2018	Volkswagen, Porsche, Mercedes-Benz
Bethel Automotive Safety Systems	WCBS	One-box	2020 (scheduled)	Chinese automakers, e.g., Chery and Geely
Shanghai NASN Automotive Electronics	N-booster	Two-box	2018	BAIC BJEV
Tianjin TRiNOVA Automobile Technology	E-booster	Two-box	2019	Refitted test vehicle for JAC-Baidu Apollo Autonomous Driving Project, technical support from Shanghai Jiaotong University and Beijing Institute of Technology
Shanghai Tongyu Automotive Technology	EHB	One-box	-	-
Ningbo Tuopu Group	IBS	Two-box	2022 (scheduled)	Under research and development

Steering by wire: intelligence spurs the industry but commercialization is hindered

So far only Infiniti has had steering-by-wire solution for mass production since its advent. In 2014, Infiniti Q50 packing steering-by-wire solution offered by KYB made a debut. Yet, in July 2016, Dongfeng Motor and Nissan recalled 6,840 units of Infiniti Q50 and China-made Infiniti Q50L in all because of potential safety risks posed by steering by wire. In current stage, Infiniti has four models carrying Direct Adaptive Steering? (DAS) solutions all from KYB.

Infiniti Models with Steering by Wire

On a global view, international tycoons like Bosch, ZF, JTEKT, NSK and Nexteer boast mature steering by wire technologies and products but they still hit a bottleneck in commercialization.

Chinese and Foreign Steering-by-wire Solutions

Supplier	Progress in Steering-by-wire Products
Kayaba	Mass-produced, and supplied for Infiniti
Bosch	Mounted on prototype car for display, expected to be mass-produced in 2024
ZF	Yet to be spawned, product description available
JTEKT	Prototype released in 2019, not mass-produced yet
Nexteer	Nexteer Quiet Wheel™ Steering & Nexteer Steering on Demand™ System showcased, but not mass-produced yet.
Mando	Expected to be mounted on Canoo in 2021
Shanghai NASN Automotive Electronics	R&D plan

In 2020, the mass production of L3 autonomous vehicles is to quicken commercial use of drive-by-wire systems. Foreign companies with an early layout in China will have first-mover advantage. Throughout the Chinese market, very few local players have made a difference in drive by wire technology, with small business scale, but the importance of drive-by-wire chassis makes them an enticement to capital and giants. In 2019, Shanghai NASN Automotive Electronics Co., Ltd. raised funds of RMB400 million. It is alleged that Huawei will set foot in drive by wire field.

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