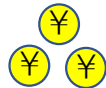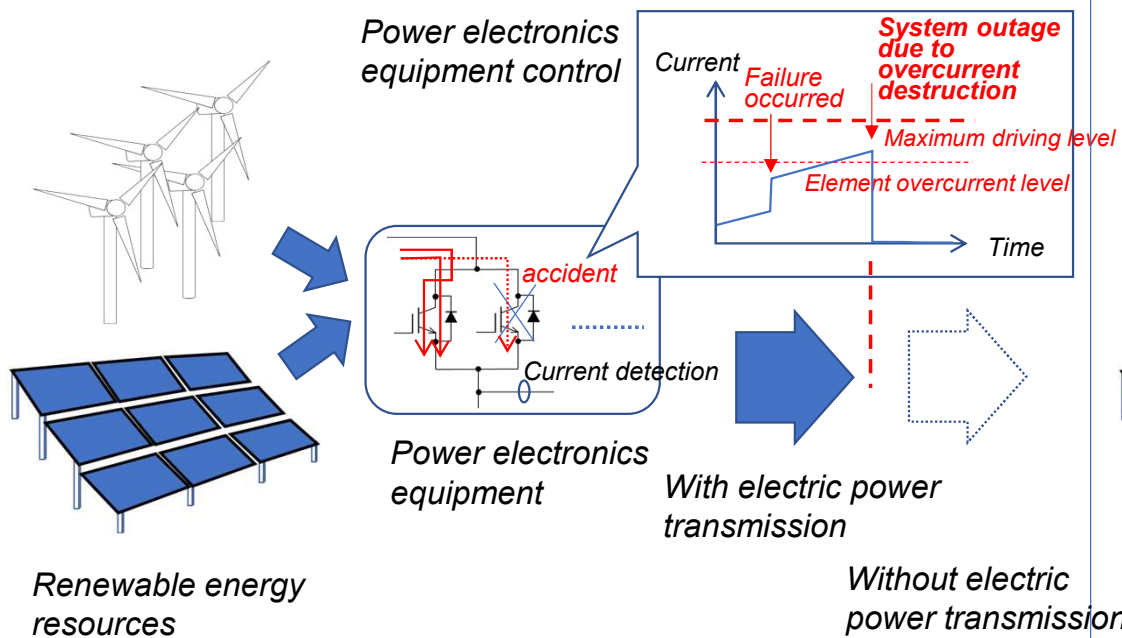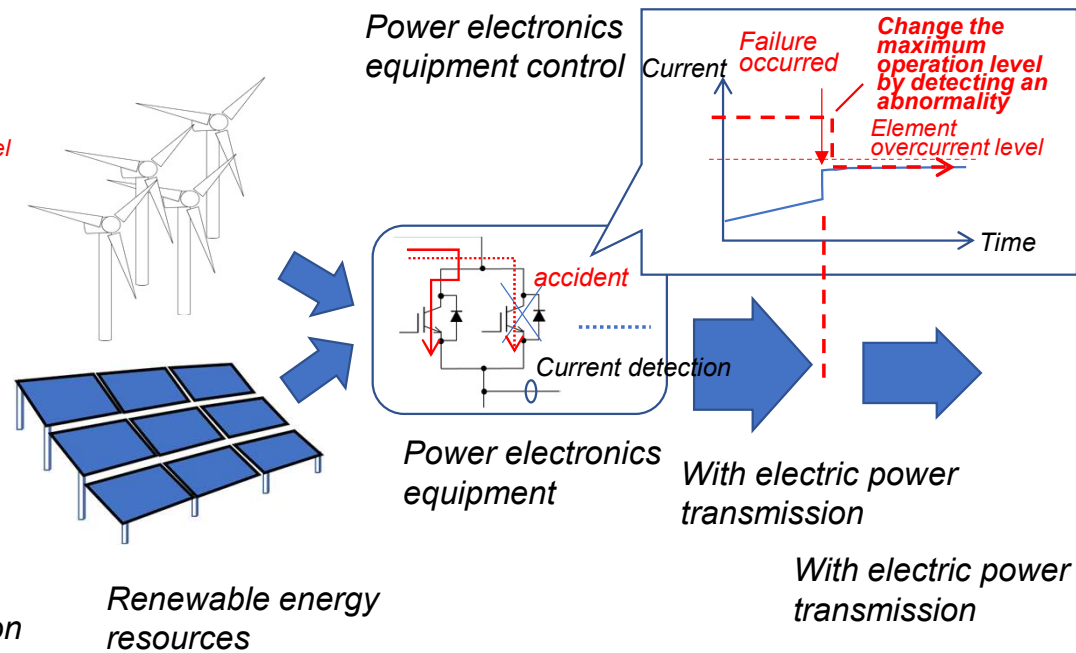Purpose: Realization of abnormality diagnosis technology for power electronics equipment utilizing machine learning that does not require deep specialized knowledge or the addition of many measuring instruments with the aim of improving the continuity of operation of electric power and mobile equipment.

Conventional power system (None abnormality diagnosis)

Power electronics equipment control

Current

Failure occurred

System outage due to overcurrent destruction

Maximum driving level

Element overcurrent level

Time

accident

Current detection

Power electronics equipment

With electric power transmission

Without electric power transmission

Renewable energy resources

Future power system (with abnormality diagnosis)

Power electronics equipment control

Current

Failure occurred

Change the maximum operation level by detecting an abnormality

Element overcurrent level

Time

accident

Current detection

Power electronics equipment

With electric power transmission

With electric power transmission

Renewable energy resources

Advantages of abnormality diagnosis function + power electronics control

1

Research summary: In the DC / DC converter, the relationship between the combination of feature extraction methods and machine learning discrimination methods and the discrimination accuracy of circuit component abnormalities is verified by simulation.
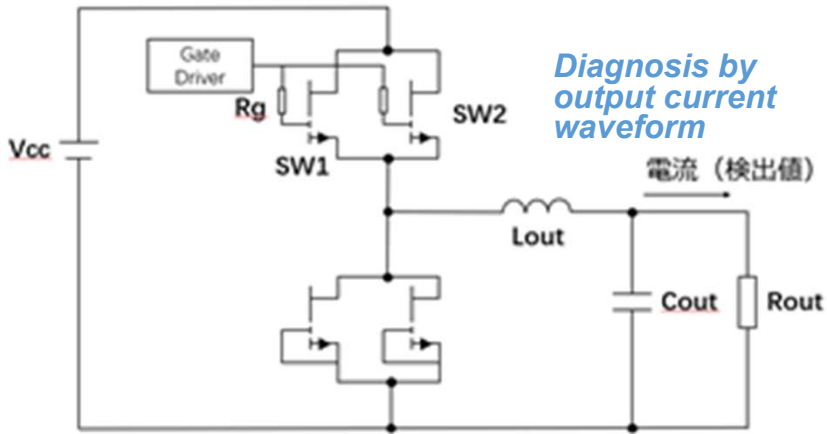
(1)Verification conditions

Diagnosis by output current waveform

電流（検出値）

Figer 1 Circuit configuration

Table 2 Other circuit parameters

SW frequency・Duty	80kHz・50%
Vcc	380～420V
Rg	0.9～1.05Ω
Rout	19～21Ω
The number of data	4122 Teaching 3402/Testing 720

Table 3 Combination of feature extraction methods and machine learning methods

machine learning / feature extraction	SVM	ANN
PCA	①	②
DWT	③	④
Waveform time analysis	⑤	⑥

Table 1 Circuit parameters 4 states to diagnose

	SW	Lout	Cout
All normal	SW1: Action SW2: Action	800 µH±5 %	0.47 µF±5 %
Only SW is abnormal	SW1: Action SW2: Stop	Normal	Normal
Only Lout is abnormal	Normal	800 µH -50 % ~ -6 % +6 % ~ +10 %	Normal
Only Cout is abnormal	Normal	Normal	0.47 µF -50 % ~ -6% +6 % ~ +10%

(2)Verification result

⑤ is better

2