

# パワーエレクトロニクス Power Electronics.

山本研究室

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【 What is power electronics? 】Power electronics consists of circuits that convert power between DC and AC. They are used in electric vehicles, trains, home appliances, and everywhere else. We aim to make these circuits smaller and more efficient from a wide range of perspectives, from the circuit components to the entire system!

## Noise Team

All power conversion circuits generate noise due to electromagnetic fields. For electromagnetic compatibility (EMC) reasons, products must meet standards. For this purpose, external noise filters are attached to the circuits, but their large volume is problematic. Therefore, we are developing a noise reduction method that does not increase the circuit volume by focusing on the circuit configuration and element arrangement!

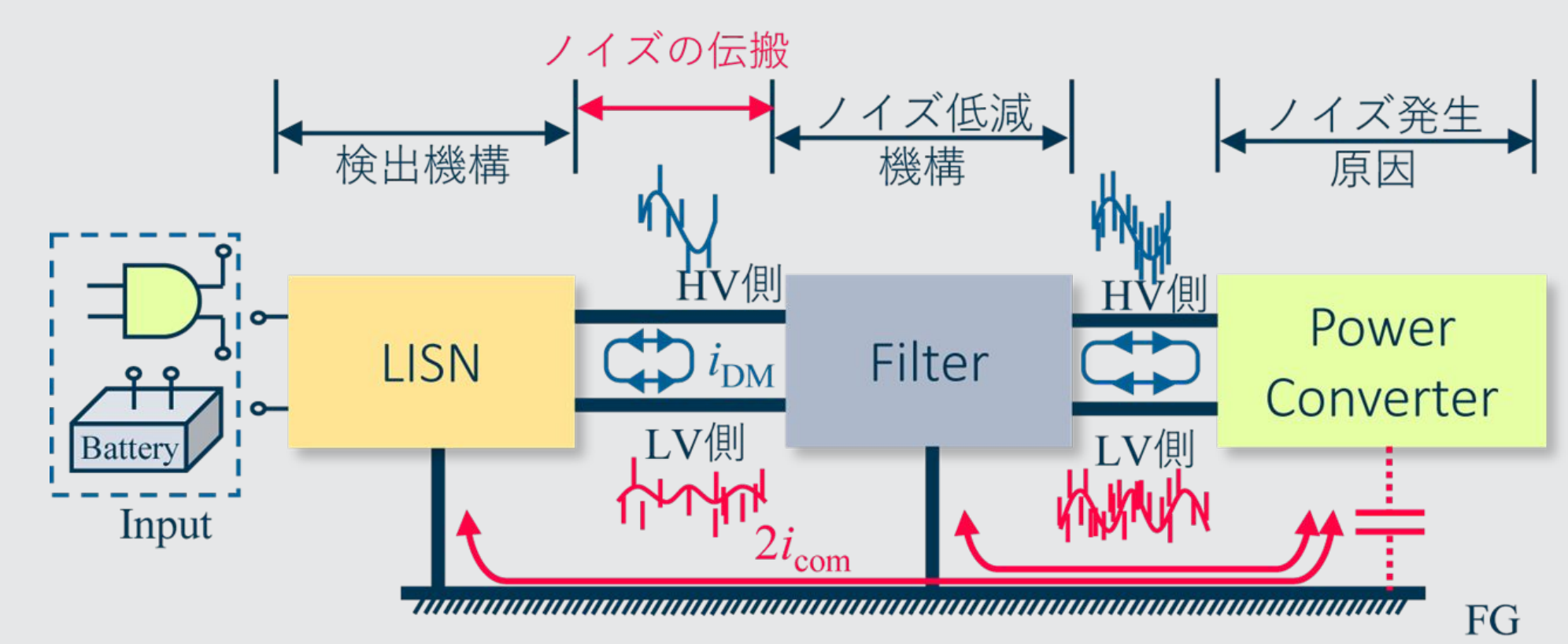


Image of the systems to remove and measure noise

## Inverter Team

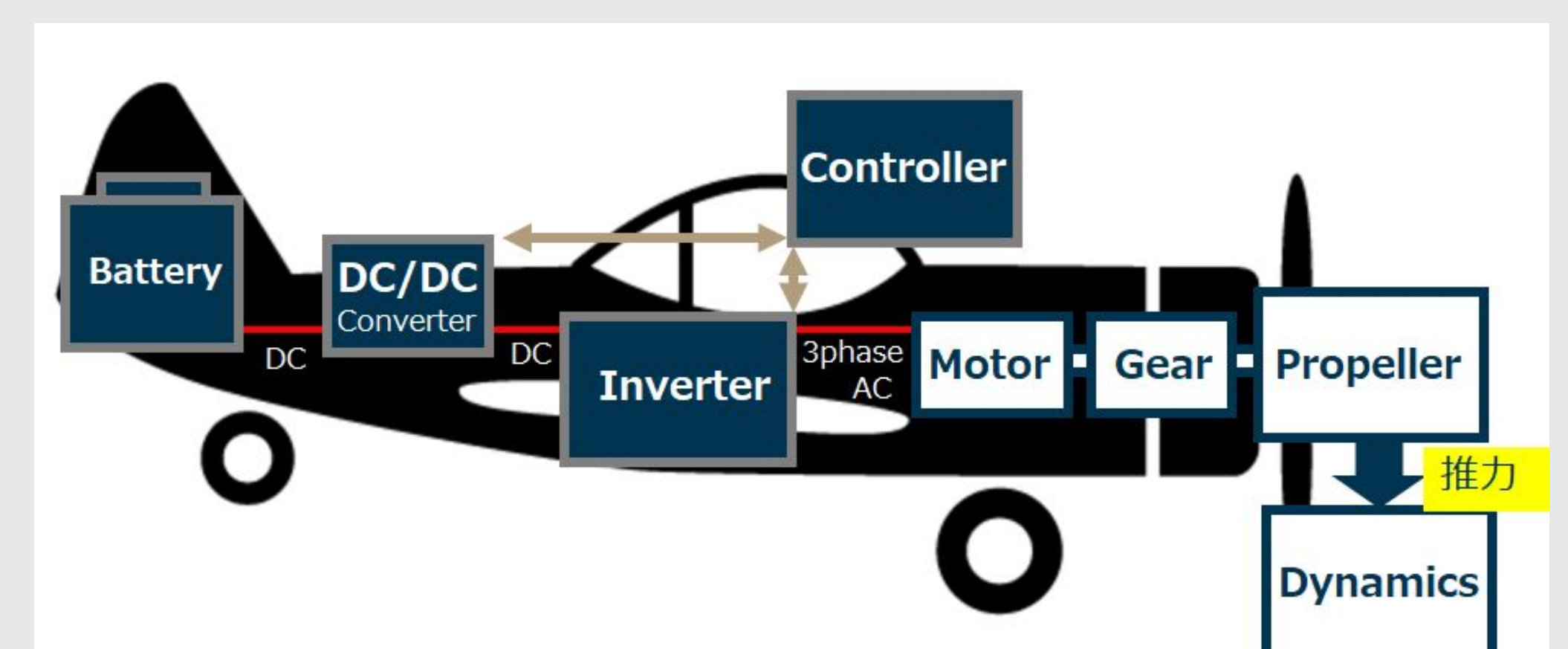
An inverter is a power converter: a device that converts DC to AC. It is essential to control motors, and a wide variety of machines such as electric cars and electric aircraft use these converters! The photo on the left shows an inverter we created. By using gallium nitride, an excellent semiconductor, we were able to achieve dramatically high efficiency! We also provide inverters to the Nagoya University Student Formula FEM, contributing to further performance improvements in cars! [photo on the right]



Inverter circuit board with gallium nitride (Left Side),  
Nagoya University Student Formula FEM (Right Side)

## Modeling Team

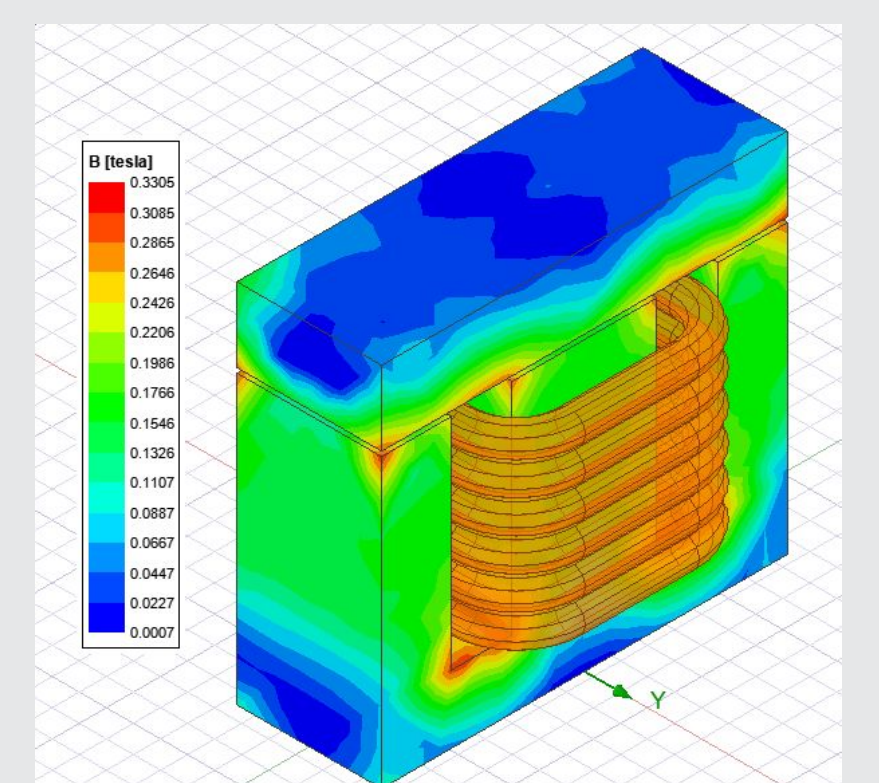
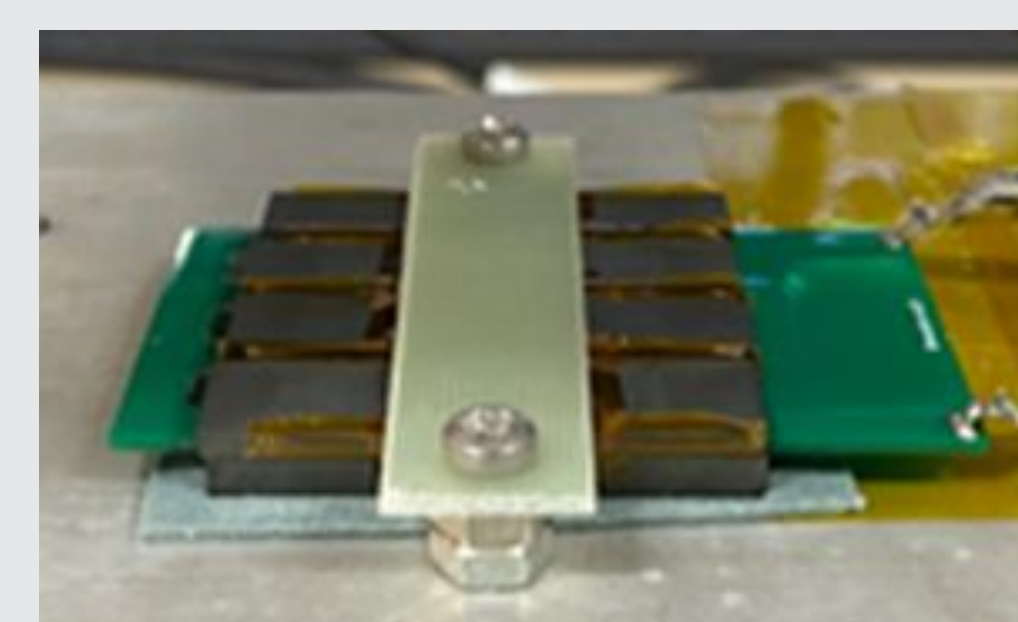
Today, electrical systems are used in automobiles, aircraft, and many other types of equipment. Therefore, many areas (thermal, mechanical, electrical ...) must be considered in the development model. We have created an electric aircraft model [photo on the right] that encompasses the entire system from the battery to the propeller. This allows us to accurately estimate the actual flight behavior in the simulation!



Electric Aircraft Block Diagram

## Passive Components Team

Passive components such as inductors and transformers are required in circuits. However, heat generation due to losses is a challenge. Thus, we focus on three aspects of magnetic components: structure, materials, and modeling. In the structure, heat generation is suppressed by reducing the thickness and expanding the cooling area [photo on the left]. In modeling, we use simulations to predict temperatures during operation, which is useful for precise design! [photo on the right]



Inductors with high heat dissipation performance (Left Side),  
Modeling of inductors in simulation (Right Side)