

## Fault-tolerant actuator system

The invention concerns an actuator system which allows up to 100 % availability. Each actuator system comprises a number of redundant actuator sub-units working completely independent which can be replaced during system operation without reducing system functionality. The invention was made by researchers of the Vienna University of Technology.

### BACKGROUND

For applications with very high demands on the operational reliability and safety actuator systems use redundant controllers, converters and actuating elements. In state of the art systems, on occurrence of a fault condition, a controller reconfiguration automatically takes place or a replacement of the whole unit – in some cases possible during operation – is necessary. Disadvantageous of these systems is the increase in system complexity – which may even reduce overall reliability as well as the requirement for a high grade of system oversizing.

### TECHNOLOGY

The proposed actuator system comprises hot-swap sub-units with widely reduced system complexity and required grade of oversizing. An active magnetic bearing (AMB) application of the proposed technology is shown. Each AMB consists of completely decoupled electromagnet (EM)-channels configured in hot redundancy, comprising the dedicated coils, controlled and driven by a decentralized hot-swap controller amplifier module (HCA).

Each HCA is responsible for controlling the position of the structure towards its dedicated EM and comprises a digital controller, a switching amplifier, local power supplies, a position sensor, and a local error detection unit. All functional EM-channels contribute to support the structure.

On occurrence of an error within a certain EM-channel this error is detected by the local error detection unit, and the defective EM-channel automatically shuts down. The adjacent redundant EM-channels take over the bearing functionality without the need for any reassignment. The replaceability of all sub-assemblies of the EM-channels during operation of the system guarantees 100 % availability.

### BENEFITS

- Up to 100 % availability
- Best operating safety

**REFERENCE:**  
M032/2006

**APPLICATIONS:**

- All safety/reliability critical actuator applications

**KEYWORDS:**

active magnetic bearing, fault detection, hot-swap, availability, safety, reliability

**DEVELOPMENT STATUS:**

A lab-model with six independent EM-magnet channels has been developed and successfully tested with up to two deactivated EM-channels.

**IPR:**

Patent granted in DE and FR

**OPTIONS:**

- License agreement
- Development partnership

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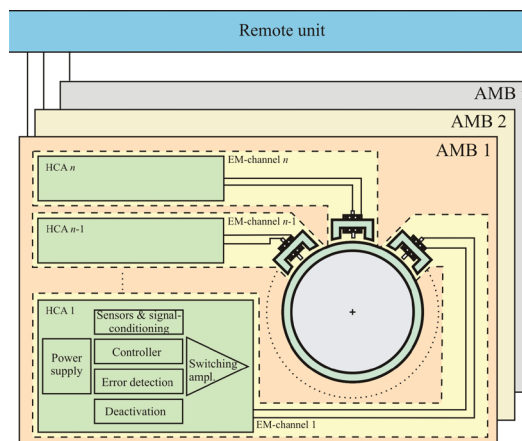


Fig. 1: Active magnetic bearing (AMB) system based on the fault-tolerant actuator system.

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