

Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

A New Class of High Speed Disconnect Switch Based on Piezoelectric Actuators

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Diskussionsleitung: Prof. Dr.-Ing. B. Piepenbreier

With the adoption of power electronic converters in shipboard power systems, the ability to isolate electric loads quickly from the power system is becoming more important than breaking high magnitude fault currents and the associated arcing between contacts. This allows for substantially faster as well as potentially lighter and more compact disconnect switches. Also, high-speed disconnect switches are required for hybrid circuit breakers, which is expected to be an enabler for future DC power transmission and distribution. The proposed new class of disconnect switch is based on a piezoelectric actuator and has the potential to isolate within less than one millisecond for use in next-gen electric power distribution systems. Finite element analysis was used to optimize geometry and material selection of the disconnect switch. Current conduction, mechanical stress, and electrostatic simulations were performed to confirm that design requirements of the switch had been satisfied. The thermal field was calculated in a transient model, allowing for the effect of temporary over-current to be studied. Structural analysis helped determine optimum thickness of insulator features holding moving contact elements, thus keeping von Mises stresses to a safe level. The electrostatic field calculations confirmed that the chosen hemispherical contact geometry resulted in minimum field enhancement in the gap.