**Bridge topology as primary switch for magnetic pulse compression circuit**

**STATE OF THE ART**

**Function:**
- Primary switch is an IGBT with Blocking Diode
- Voltage matching with pulse transformer
- Pulse compression with non linear magnetic pulse compression cores (PCC)
- Energy recovery with recovery inductor (L_Recovery)

**Disadvantages:**
- The charging has to be done via the charging recovery inductor (L_Recovery).
- The primary capacitors see up to 50% voltage reversal.
- The recovery time couldn’t be used for charging. Up to 10% of the duty cycle couldn’t be used for charging.
- The voltage reversal needs about 5% of the reflected energy and reduces so the overall efficiency of the circuit.
- Charging inductors are bulky and produces fringing fields (depending on the design).
- The circuit cannot handle high impedance loads.
- The voltage of the IGBT is not clamped. Too short triggering of the IGBT and other failures in the circuit can damage the IGBT due to overvoltage.
- The series diode of the IGBT adds losses and is also affected by over voltage.

**Advantages:**
- The switch needs only very low off switch capabilities, so Thyristors and GTOs are also suited as a switch (the circuit is originally designs for such switches)
- Only one switch which is on ground potential.
- Proven design

**NEW DESIGN**

**Function:**
- Primary switch is an IGBT bridge
- No change necessary for Pulse Transformer and pulse compression
- Fast off switching of the IGBT after Energy transfer
- Magnetic assist blocks energy back flow
- Energy recovery direct by the free wheeling diodes in the Bridge

**Advantages:**
- Diodes and IGBTs are protected from overvoltage
- Fast voltage recovery and hence very fast recharging is possible
- No snubber circuits are necessary
- Direct charging of the bank is possible without charging inductor or charging switch
- High efficiency
- Open loop load causes no damage to the semiconductors
- No voltage reversal at the bank capacitor

**Disadvantages:**
- Double amount of semiconductors
- Insulated gate drives
- Precise off switch of the IGBT
- Bigger magnetic assist

**MEASUREMENTS**

**Ch1:** C_Bank2 voltage (5 kV/Div)
**Ch2:** C_Bank1 voltage (5 kV/Div)
**Ch3:** IGBT current (400 A/Div);
**Ch4:** C_primary voltage (200 V/Div)

**Conclusion:**
- The new design works
- Interesting for high repetition rate (beyond 1 kHz)
- Works with short circuit and open loop
- more Semiconductors; less inductors