

## **Abstract**

Currently, low-and medium-power motor drives used in electric traction and industrial applications are based on voltage source inverters (VSIs) either with open-loop V/Hz control or with vector control. The introduction of current source inverters (CSIs) into this field could lead to marketing advantages due to the advantageous characteristics of this currently less used converter topology. These advantages including: (i) a simple structure; (ii) short-circuit protection; (iii) bidirectional operation; (iv) nearly sinusoidal inputs and outputs; (v) the absence of electrolytic capacitors; and (vi) the possibility to connect in series the power switches, make the use of CSI in high-power medium-voltage drives highly desirable. In the low voltage, 10–100 kW power range, the use of CSIs is currently limited to a few high-level applications that require recognised machine-friendly characteristics, especially in the case of low-inductive machines such as the high-speed squirrel-cage induction motors used in metal cutting Machinery and permanent-magnet excited synchronous machines with various geometries. Conversely, the use of a six-step CSI with a pulse-width modulation (PWM) rectifier allows the realisation of a low-cost drive with a reduced size for the DC-link inductor, thus improving the reliability, lifetime, and transient response. The development of switching devices has extended the application of CSIs into a lower power range, since the cost of the reactive components can be reduced and the dynamic performance can be improved if a higher switching frequency is used protected that resonance is prevented by appropriate measures. CSI and VSI can be compared by considering also the effect on motor drives. The experiments are designed to highlight harmonic losses, insulation stress, and common-mode phenomena. The losses in the induction motor as well as in both inverters are measured under several steady-state operating conditions. The voltage stress generated when the motor windings are switched on has been recorded. The common-mode voltage and current are also quantified, and an analysis of the shaft voltage is presented. This plenary presentation will review the most and less common techniques for the control of CSIs and will introduce some newer topology including a voltage clamp circuit to realize a soft switched DC/AC current source inverter.