A Novel Transformer with Compensating Coil

Xiaodong Liu 1*, Qichang Liang 2, Yu Liang 3

1. 4050 Tokay Court, Napa, CA 94558, USA
2. Department of Nuclear Physics, China Institute of Atomic Energy, P.O. Box 275(10), Beijing 102413, China
3. Pangeo Corporation, 2005 Black Acre Dr., Oldcastle ON, N0R 1L0, Canada

* Email: liuxiaod@gmail.com

Abstract

In this invented transformer, a compensating coil is series connected with the secondary coil in opposite polarity. The magnetomotive forces generated by the loading current in the secondary coil and the compensating coil are cancelled out. The power can be delivered with zero input current in the primary coil when the turn number of secondary coil is the same as that of compensating coil. When a boost coil is added to the compensating coil, the input current in primary coil is phase inverted relative to its input voltage. A magnetic shunt is added to adjust the flux leakage of this transformer.

Description

This transformer is composed of magnetic core, magnetic shunt, primary coil A, secondary coil B and compensating coil C. The schematic of the transformer is shown in Figure 1. The primary coil A and secondary coil B are mounted in-and-out or adjacently on one side of the magnetic core; the compensating coil C is mounted on the other side of the magnetic core. There are air gaps between the magnetic core and the magnetic shunt.

If the output terminal is composed by the secondary coil B alone, the transformer must require input current through primary coil A to cancel out the magnetomotive force

generated by the loading current in coil B. If the output terminal is composed by series connecting coil B and coil C with opposite polarity and the turn number of coil B is the same as that of coil C, the inducted voltage on coil B is larger than the inducted voltage on coil C due to the magnetic flux leakage through the magnetic shunt and air around the magnetic core. The output voltage is

$$V_{output} = V_B - V_C \quad (1)$$

The loading current through coil B and coil C supply equal but opposite magnetomotive force in the magnetic core and they cancel out each other so that the transformer doesn't require input current through primary coil A. The voltage difference between coil B and coil C can be adjusted by changing the position of the magnetic shunt.

If a boost coil is added to coil C so that the turn number of coil C is more than that of coil B and the inducted voltage in coil B is still larger than coil C, the primary coil A must supply a phase inverted current relative to its input voltage to cancel out the extra magnetomotive force generated by the boost coil. The inducted voltage in coil B must be larger than that of coil C, otherwise the transformer will require more input power than the output power.

Acknowledgement

Special thanks to Mrs. Yulan Yao, Mr. Jian Liang, and Mr. Fengjun Zang for their encouragement and financial support to this work.

References

[1] Xiaodong Liu et al, *Novel Transformer Using Compensating Coils*, United States Patent and Trademark Office, Application Number 61/619867, April 3, 2012.

Figure 1: Schematic of the transformer using compensating coil. The black dots indicate the polarity of each coil.