



OO/UC3M/30 – METHODOLOGY FOR THE IMPROVEMENT INTEGRATED MAGNETICS DESIGN, AND SOLUTIONS OBTAINED APPLYING IT

Technology offered by Carlos III of Madrid University, Spain. It allows increasing the optimization capability of the design of integrated magnetic components, by means of the extension of the degrees of freedom in the design procedure. It is possible to simplify the design, improved performance and reduce size and costs of the component. Custom made solutions based in this method, applied to electric systems or power electronics, are offered.

Description of technology

A systematic methodology to improve the design of integrated magnetic components for power electronics is presented. Some examples of components designed by this method are included.

Magnetic integration for power converters was firstly proposed several years ago. It is applied in order to reduce the number of ferromagnetic cores needed in a power electronic system, and it allows increasing the overall efficiency of the system.

The magnetic integration for power converters can be reached in terms of a core sharing approach (core integration) or a winding sharing approach (winding integration). Solutions with winding sharing approach allow reducing the needed copper quantity. However, design in these cases is more difficult, since the equivalent integrated discrete components that share their winding are defined by the same number of winding turns and, therefore, they cannot be designed separately.

In this patent is presented a systematic methodology that allows overcoming the interrelation effect in winding sharing approach.

Following the proposed method, it is possible to increase the number of degrees of freedom in the design of an integrated magnetics topology with both core sharing and winding sharing, whose equivalent integrated elements cannot be separately designed. A split procedure of the winding of the component is carried out, and extra quantity of copper is not required. Applying this technique, the design procedure is simplified and the optimizing ability is increased. It can be applied over any solution with both core sharing and winding sharing that fulfill some requirements.

On the other hand, different solutions in magnetic integration, useful for filtering in power grid connections, are introduced. Two topologies of integrated LCL filter and single phase transformer, useful in inverter applications, are incorporated as examples of the application of the methodology.

Innovative aspects

Integrated magnetic for power converters is a well established and widely used technique. The lack of degrees of freedom in the design procedure is a problem previously studied. However, the developed solutions have been only applied for specific topologies and converters. This patent presents a generalized design procedure to be applied for any integrated magnetic solutions where this problem appears.

Competitive advantages

To apply the offered design methodology or any of the topologies of integrated magnetic component designed by this method allows a size, weight and cost reduction of the components. The rise of optimization capability implies:

- Air gap reduction (EMI and losses reduction).
- Reduction of total winding turns.
- Magnetic core size reduction.
- Energy efficiency increase.

Current state of intellectual property: Patent applied



Universidad
Carlos III de Madrid

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Contact Person: María Dolores García-Plaza

Phone: + 34 91 624 9016 / 9030

E-mail: comercializacion@pcf.uc3m.es