

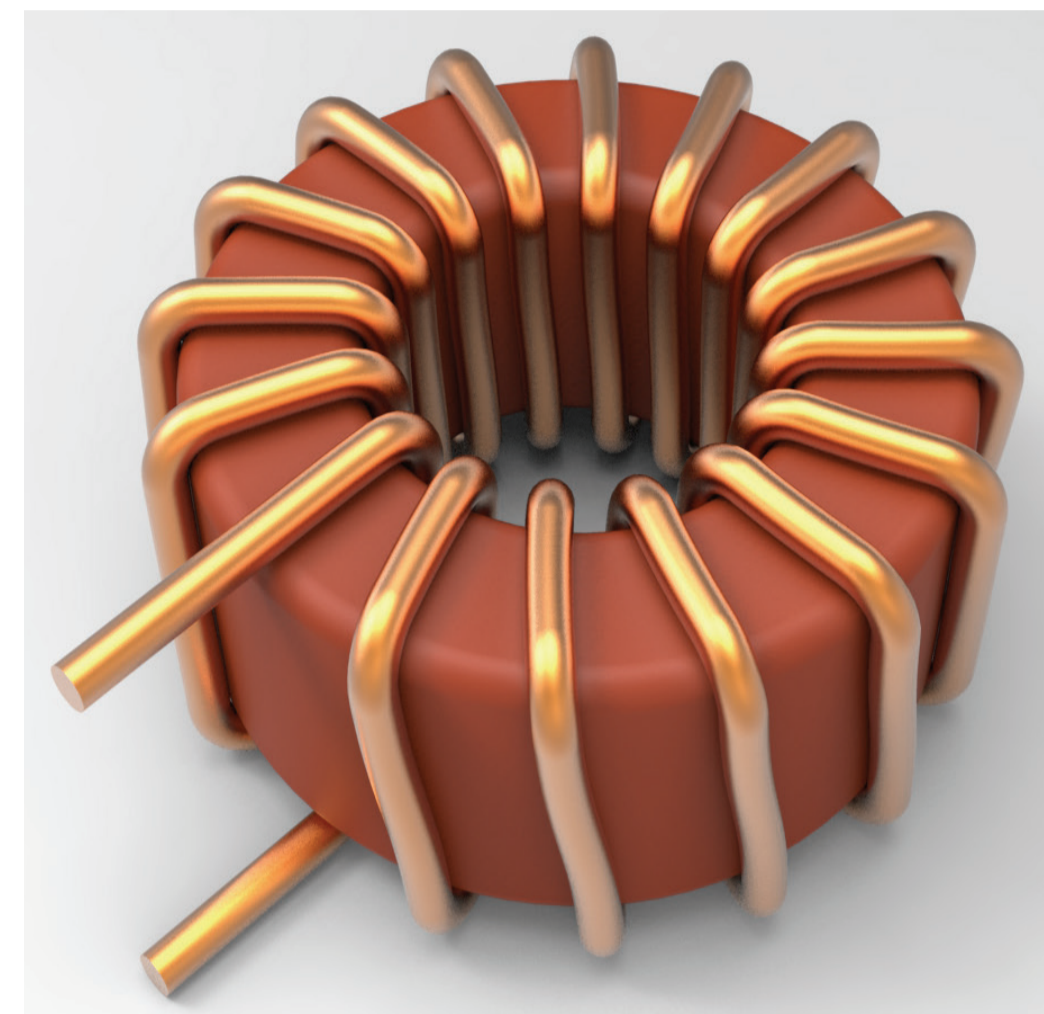
Investigation of a Hybrid Winding Concept for Toroidal Inductors using 3D Finite Element Modeling

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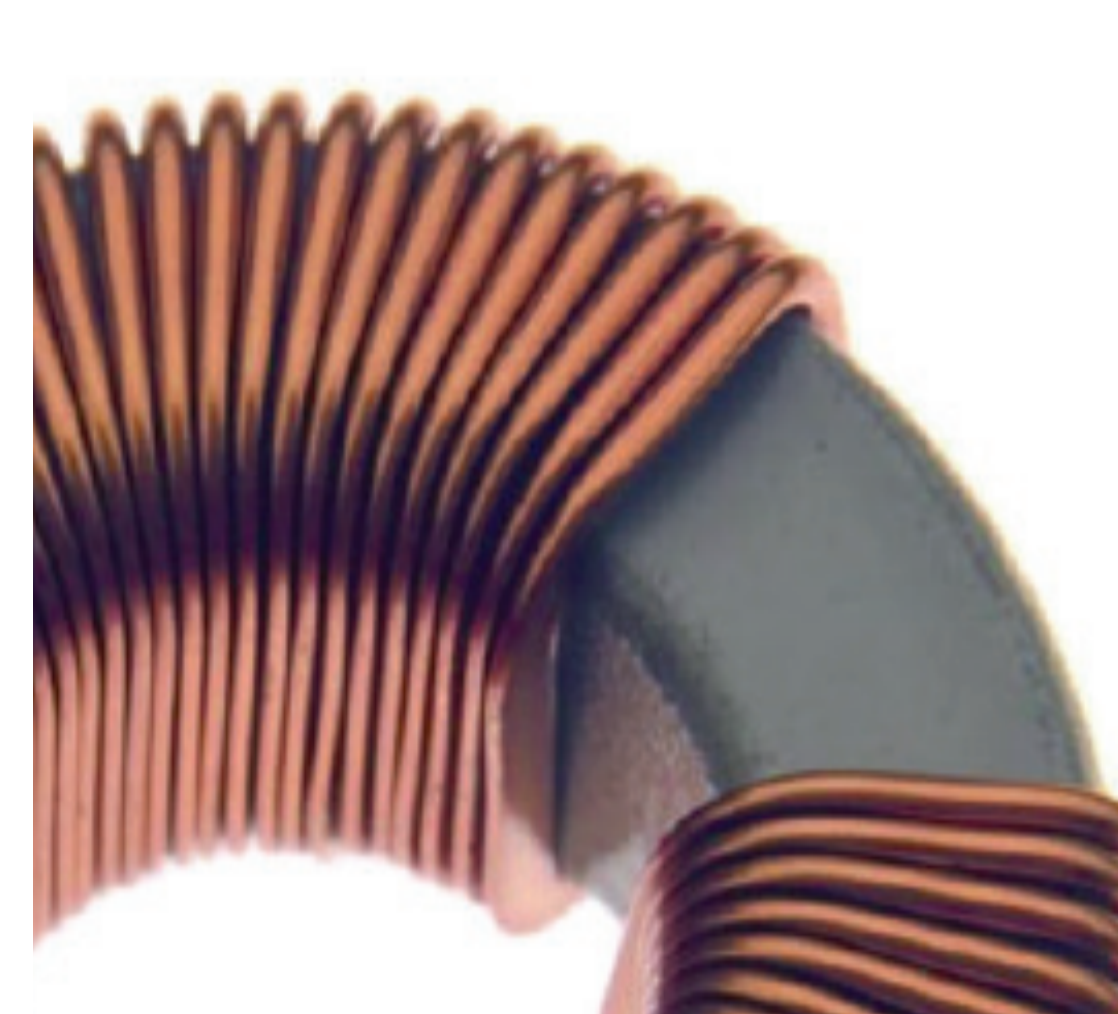
Single layer toroidal inductors

Prior art

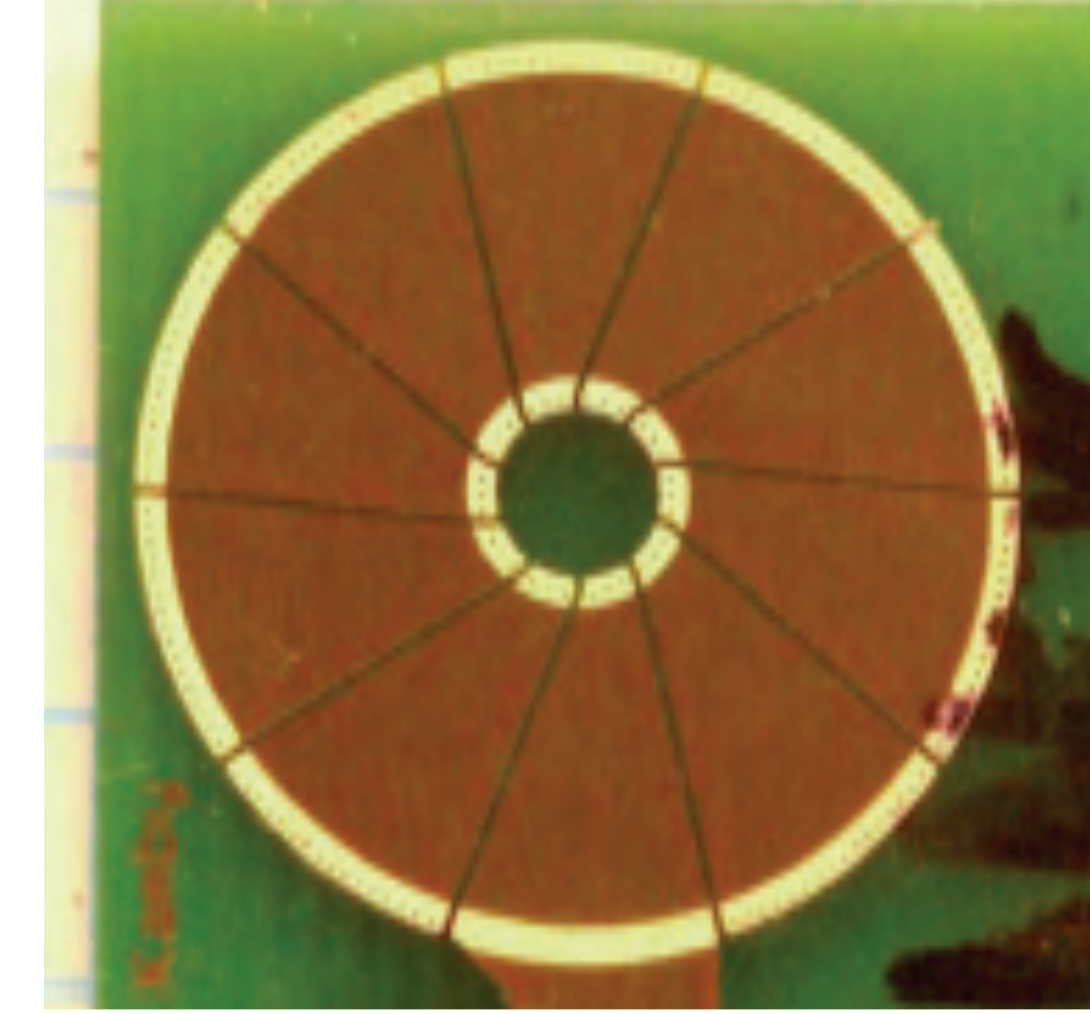
- Limited utilization of winding space.
- Manual manufacturing process or complicated integration of the core material



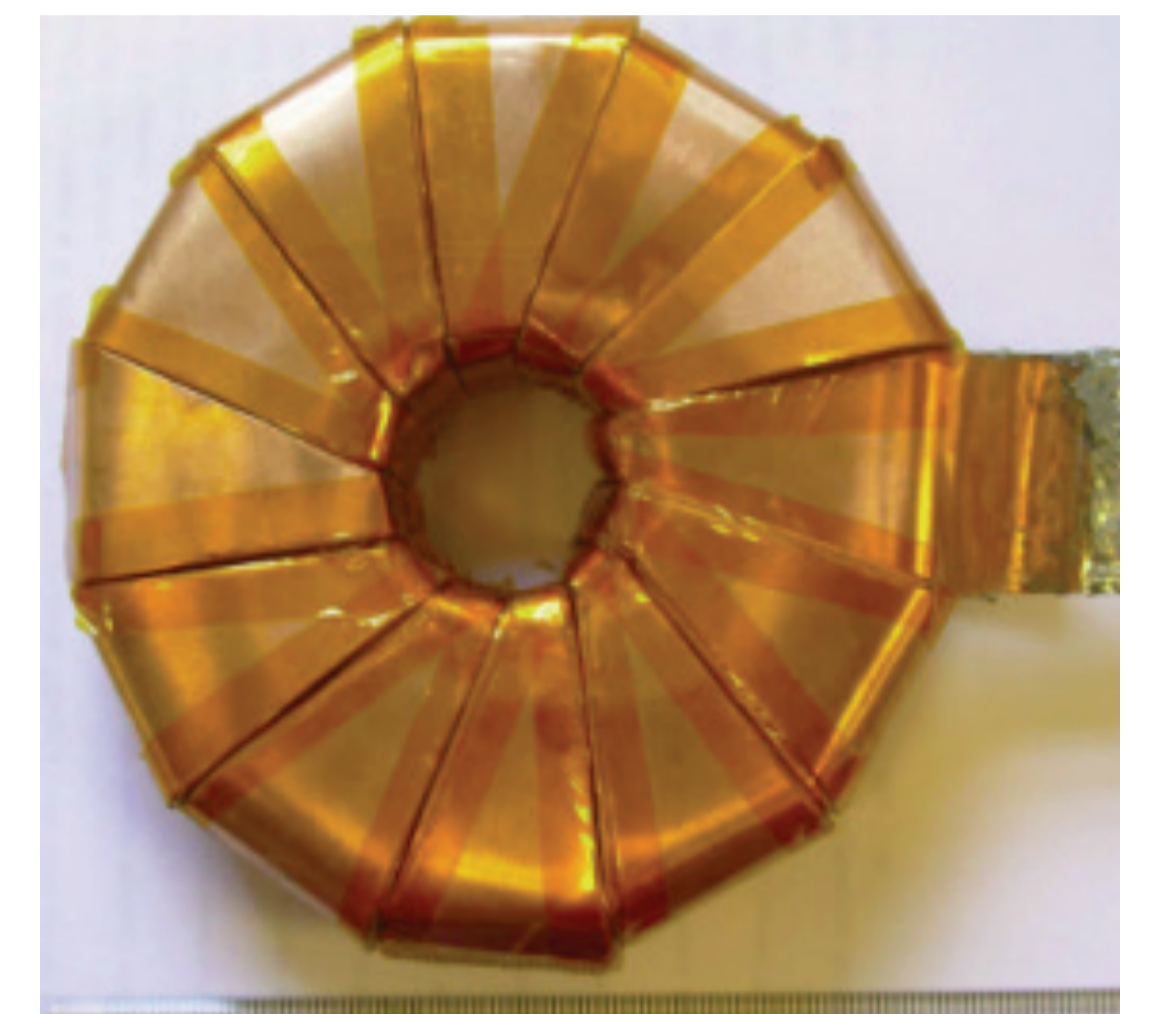
Conventional wire wound



Squeezed wire wound

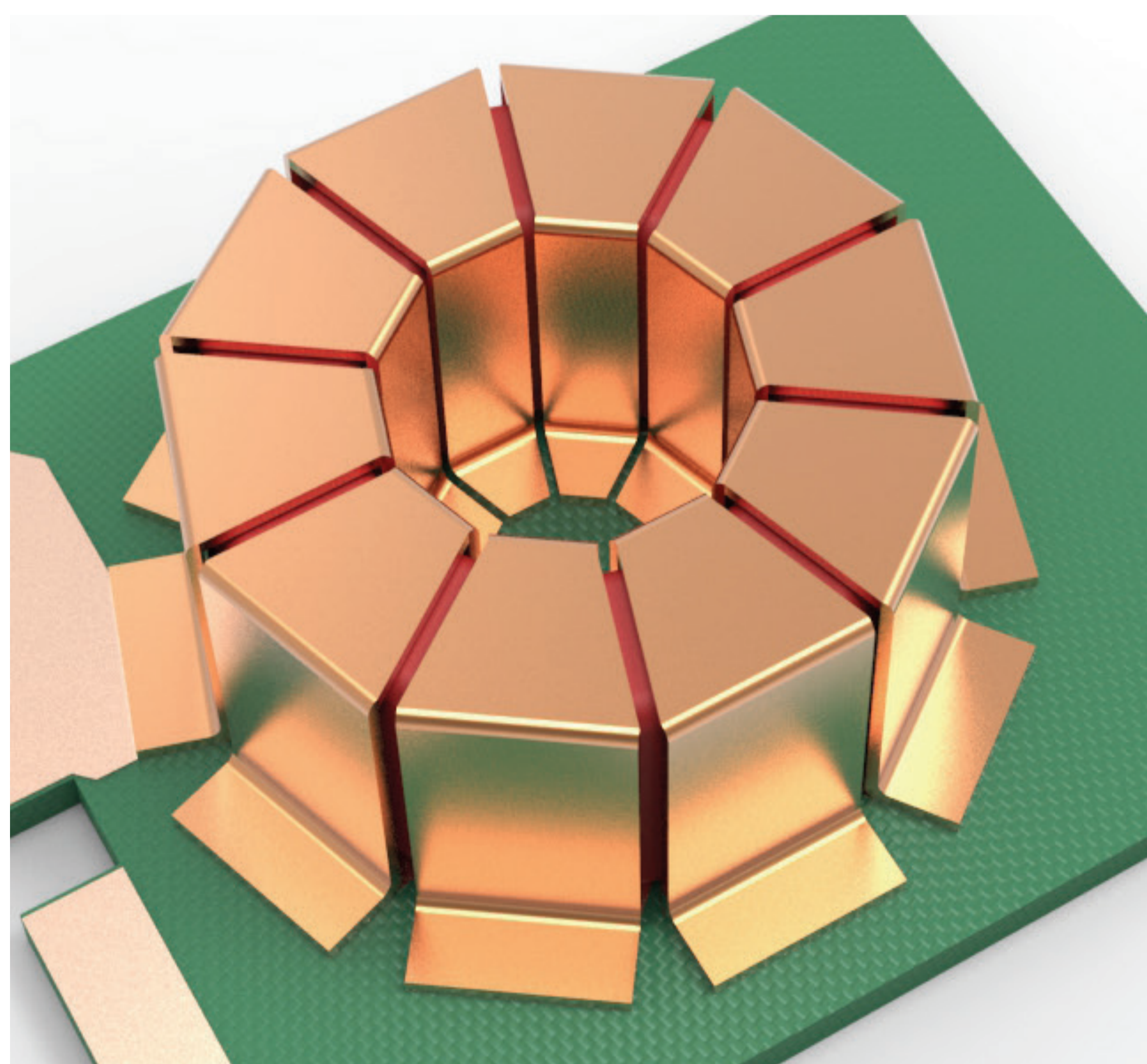


PCB integrated



Foil wound

Hybrid Winding Concept



Example of a hybrid winding inductor, non-optimized with regards to the resistance.

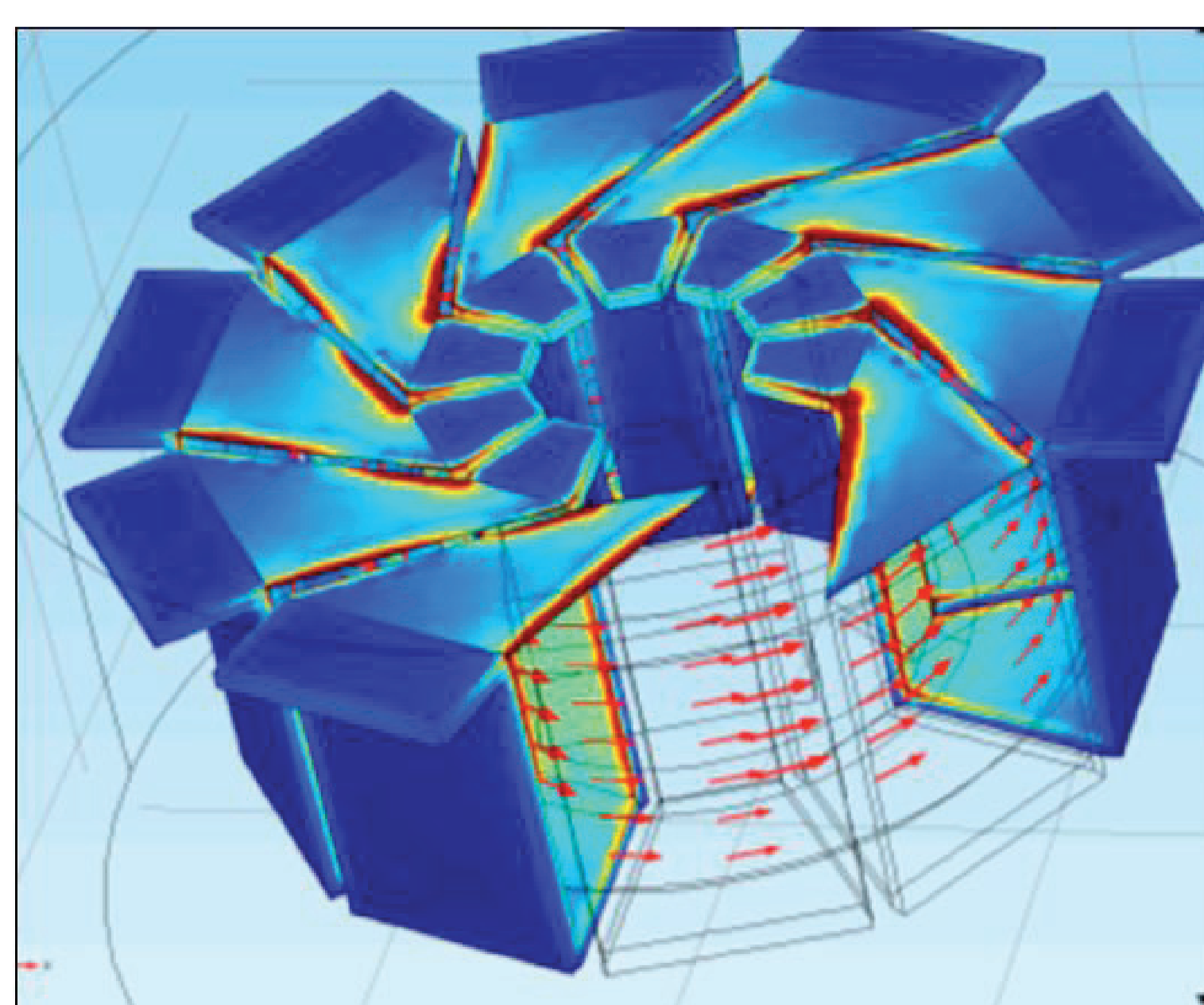
Advantages

- Fully automated process. From cutout to pick and place.
- Good utilization of winding space.
- Low AC resistance due to increased surface area.
- Configurable winding structure.
- Different core materials can be used with the same foil assembly.

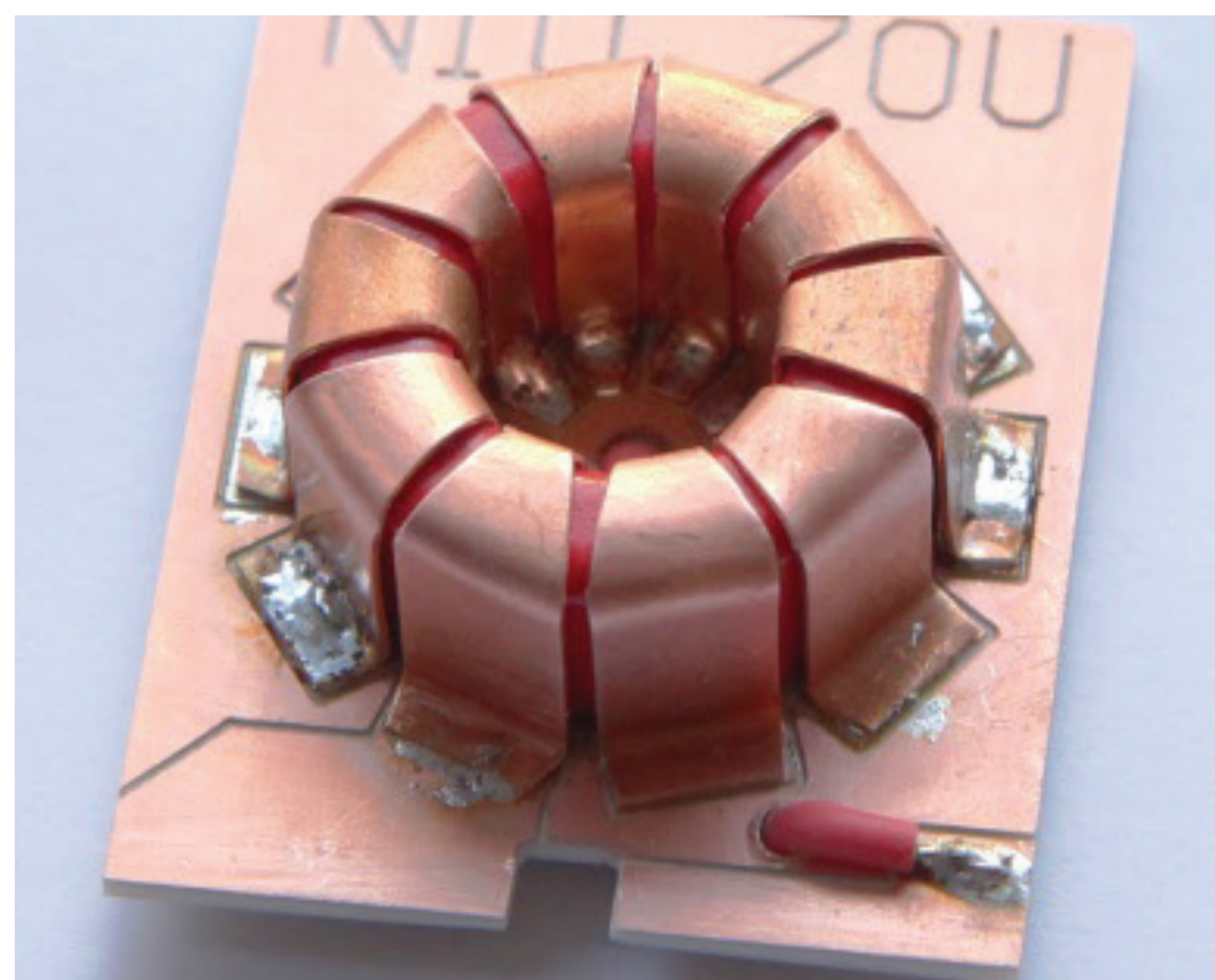


Exploded view of a hybrid winding inductor.

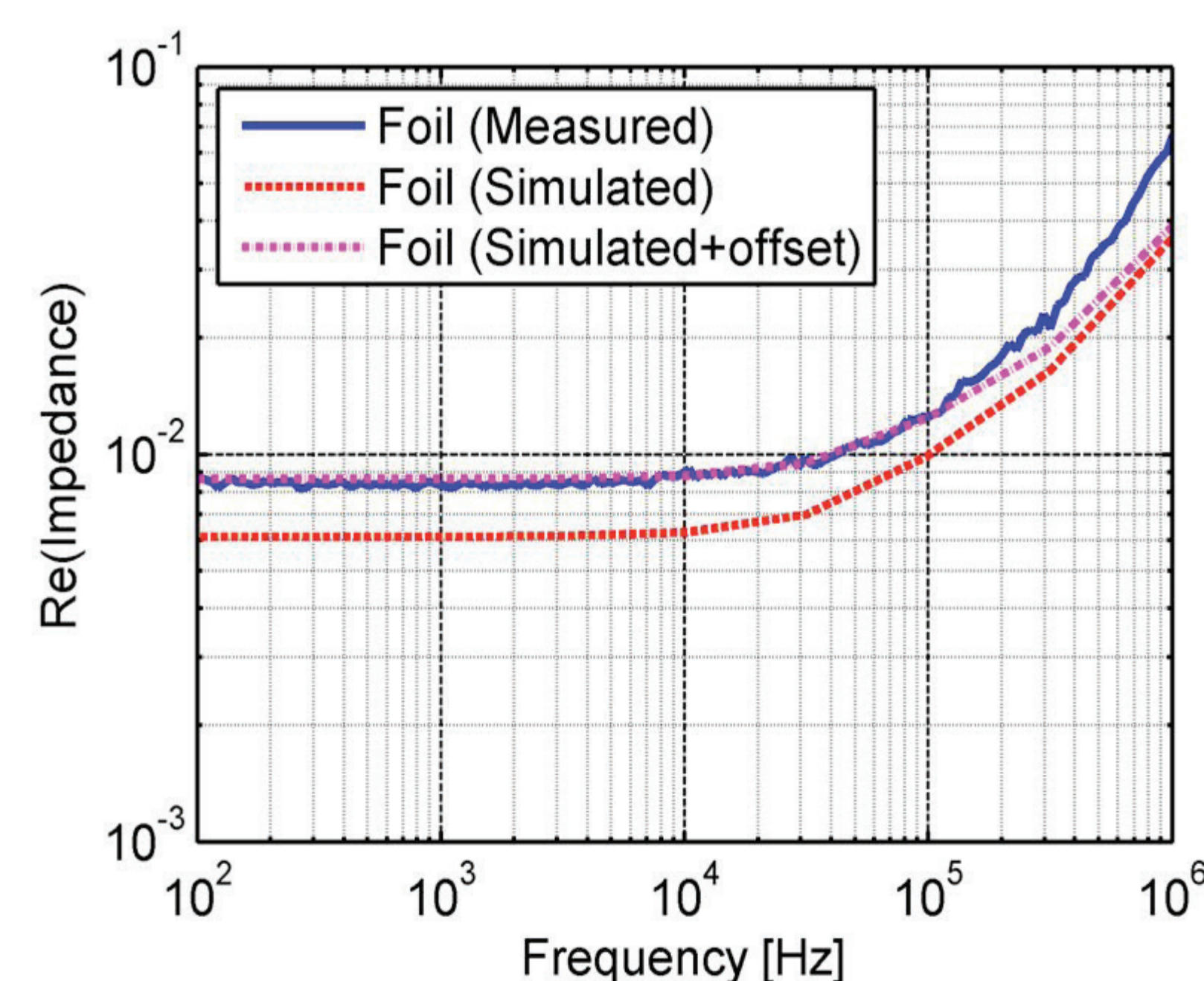
Results & verification



COMSOL simulation of the 3D structure to find the impedance of the structure.



Prototype of a hybrid winding inductor for real world measurements.



Comparison of the simulated impedance and measurement.

Conclusion

- Alternative winding concept.
- Winding configuration are critical in terms of DC resistance.
- Future research is required in optimal winding configurations.