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AN ALTERNATIVE CIRCUITRY FOR A TRANSFORMER COUPLED LC INVERSION GENERATOR

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A new alternative circuitry for the transformer coupled LC inversion generator (TCLCG) is presented.
In principle, a TCLCG consists of one in-phase 1:1 transformer and two capacitors per elementary stage. First, the two capacitors will be charged via the primary winding of the transformer in opposite polarity. Afterwards, voltage multiplication is being achieved by a closing switch which shortcuts the two capacitors. The odd-numbered capacitor discharges slowly through the primary inductance of the transformer, whereas the even-numbered capacitor discharges fast through only the leakage inductance of the transformer and thus inverts.
However, one of the main drawback of the classical TCLCG circuitry is caused by the fact that connection of the transformers of the higher generator stages is done through the transformers of the lower stages. Consequently, compensation techniques must be applied, i.e. adjustment of the even capacitors and/or transformer inductance values, in order to ensure effective voltage multiplication by means of constructive superposition of each stage. This limits the maximum achievable generator stage number and rise time.
In the alternative TCLCG circuit principle, the connections to the primary and secondary inputs of the transformers of the higher stages are being done directly from the closing switch. Now, the transformers are in parallel to each other, not in series as in the classical TCLCG circuitry. As a result, the even numbered capacitors see the same leakage inductance and compensation techniques are no longer necessary. First experimental verification was done by direct comparison of the classical and alternative circuitry for two compact 2-stage TCLCGs with identical transformers and capacitances. The results showed that the alternative circuitry leads to a fast generator rise time of 25 ns, about 35% faster than the classical circuitry, while still reaching the same generator efficiency of 67%.

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