Discussion on Differential Mode and Common-Mode Noise on Power lines

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The phase and neutral lines for a single phase line can be written as shown where there are two types of noises being considered.

(1)

(2)

(3)

(4)

* We can compute *Vcm* easily through (3) in software.
* We cannot compute *Vd* through (4) since ϕ is not known even though *V0* and *ω* are known.
* However, if we integrate (4) across integer, *N*, cycles of time period *T*, then we can get *Vd* since the sinusoidal term will integrate to 0.

Research questions

1. Is this software technique cheaper and more accurate than the expensive hardware techniques (using autotransformers, complex circuitry) used in LISN and other similar circuits?
2. How do the hardware circuits remove the component? I suspect, they have a low pass filter to remove the component with cut off frequency above *ω.* Is that the case? Is the proposed software technique better since it introduces a notch filter (with very thin bandstop characteristic)? Does the filter characteristic get narrower when *N* becomes higher?
3. All noise components of that fall on *ω* and its integer harmonics will get removed. Is this hypothesis true? Do many components give rise to EMI which have the same noise characteristics as the power signal?
4. If the power signal deviates from *ω,* then the integration across *N* cycles of *T* will not remove the power signal and therefore, we will not accurately compute *Vd.* Amarjeet’s figure shows that the power signal’s frequency is fairly stable. However, will the error introduced by the signal processing due to the frequency deviation be greater than ?
5. Do these principles apply across a three phase circuit? How can they be modified to three phase circuits?
6. Can we patent this or write a paper? Need to do some more background study as well as experimental verification