

# Comparing Half-wave and Full-wave Multi-voltage Rectifiers.

*Giorgio Fontana, IN3IEX July 2011*

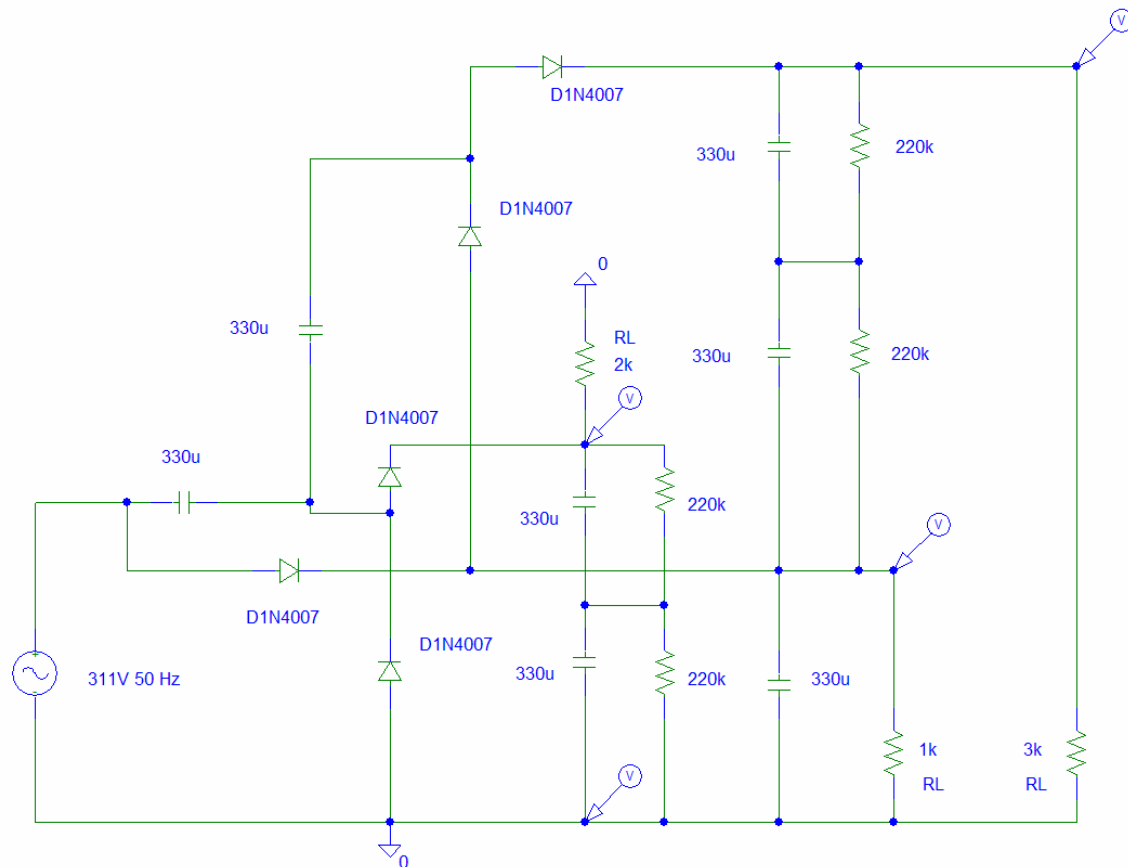
Multi-voltage rectifiers/multipliers are common circuits employed in a large number of power supplies. It is believed that the various circuits are almost equivalent regarding the voltage drop as function of the total capacitance and the load current.

I want to show that this is not true. There is a preferred circuit, and this circuit is almost unknown to most designers.

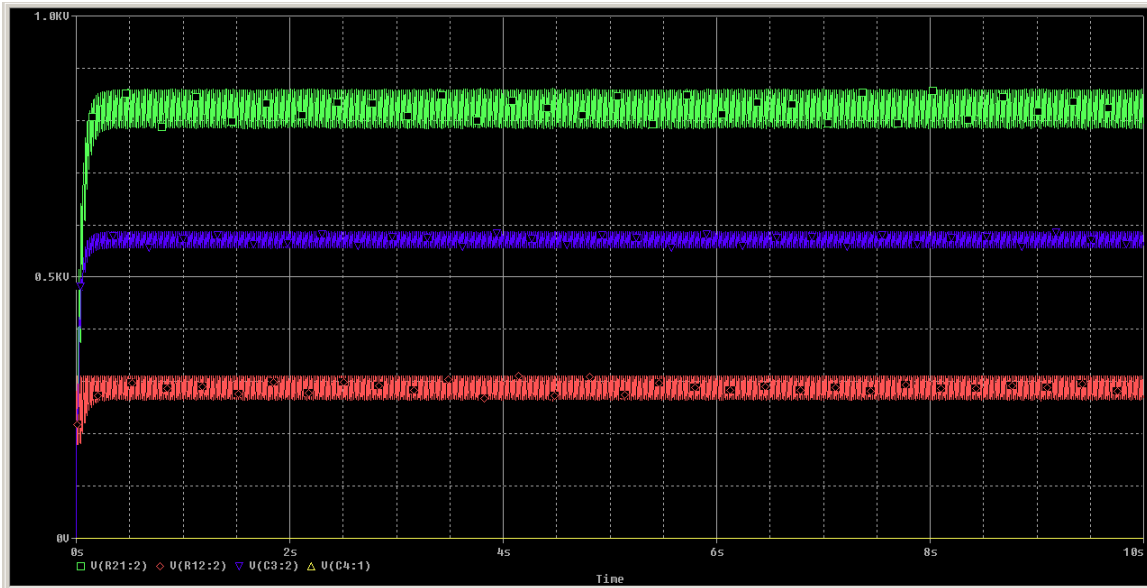
Because accurate analytical study of non-linear circuits is nearly impossible, I present a couple of SPICE simulations.

All capacitor are 330 uF and are “all” charged to the peak voltage of the input sine voltage ( $220 * \sqrt{2}$  for a 220 VAC). Both examples are a combination of a rectifier, a doubler and a tripler. As expected, no load voltages are the theoretical ones, therefore the simulation shows only the results of Multi-voltage rectifiers loaded by resistors as shown in the schematics.

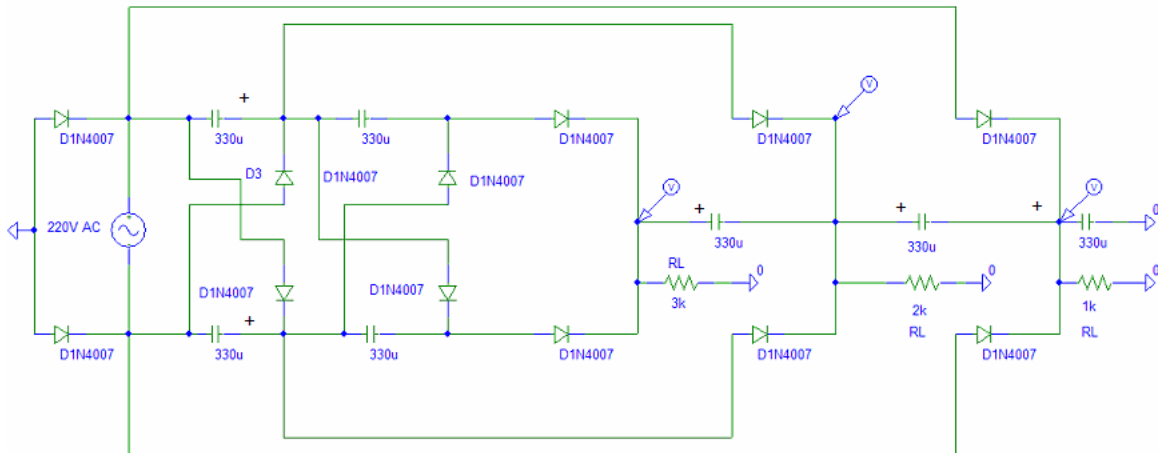
The usual half wave, multi-voltage multiplier is:



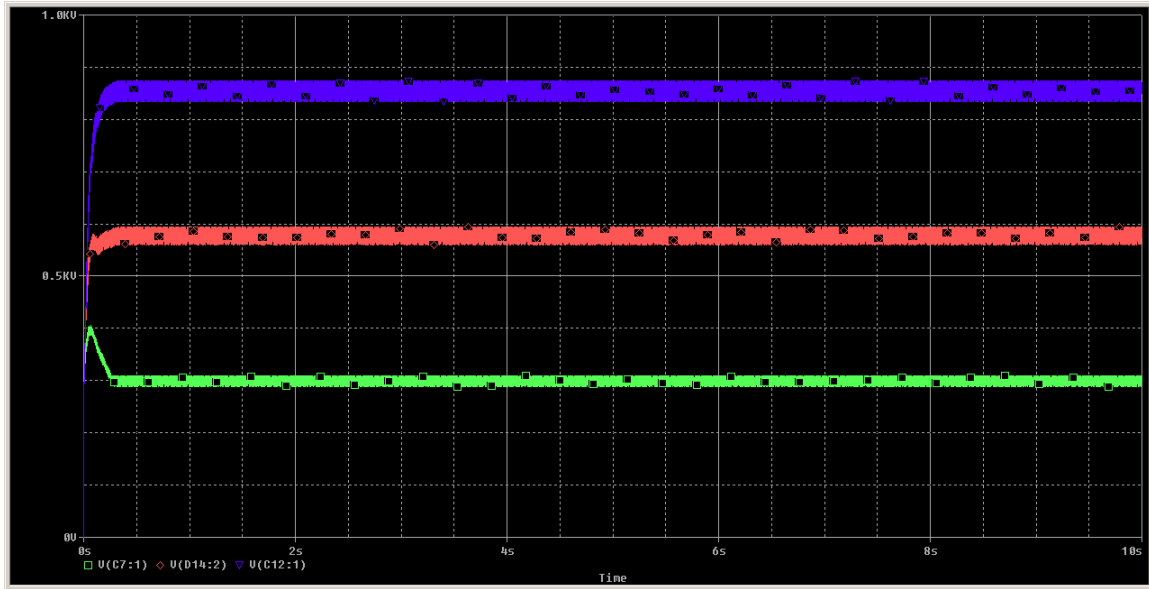
With loaded voltages:



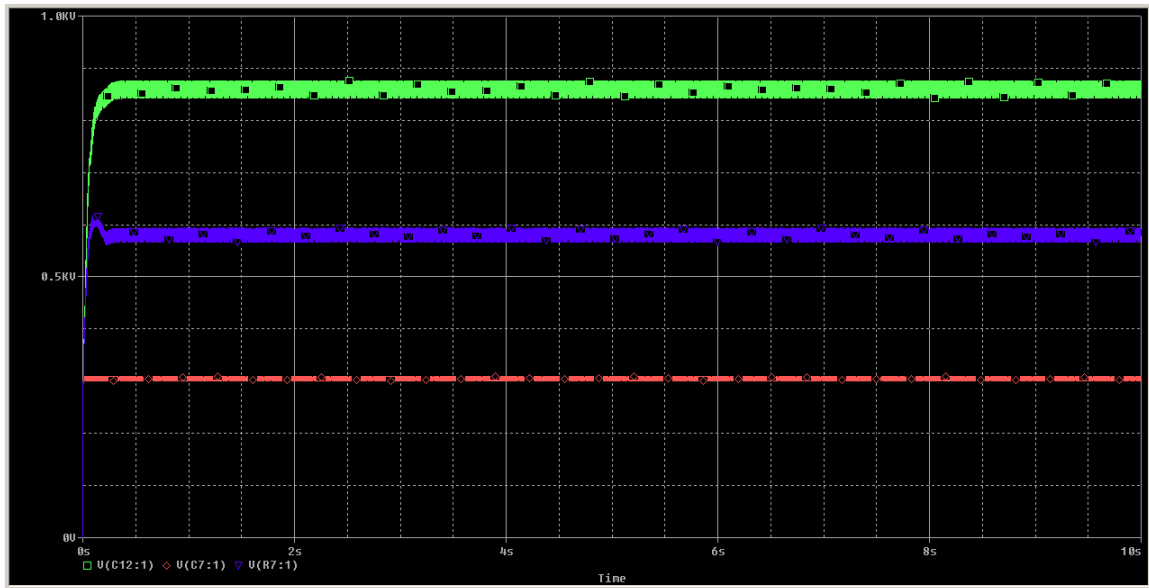
The full wave design is:



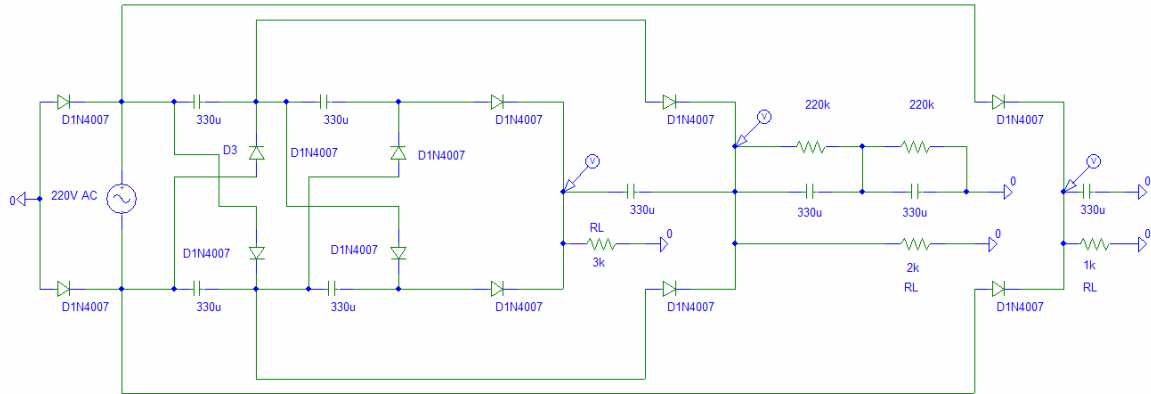
That provides the loaded voltages:



With an additional capacitor we have:



The improved design is:

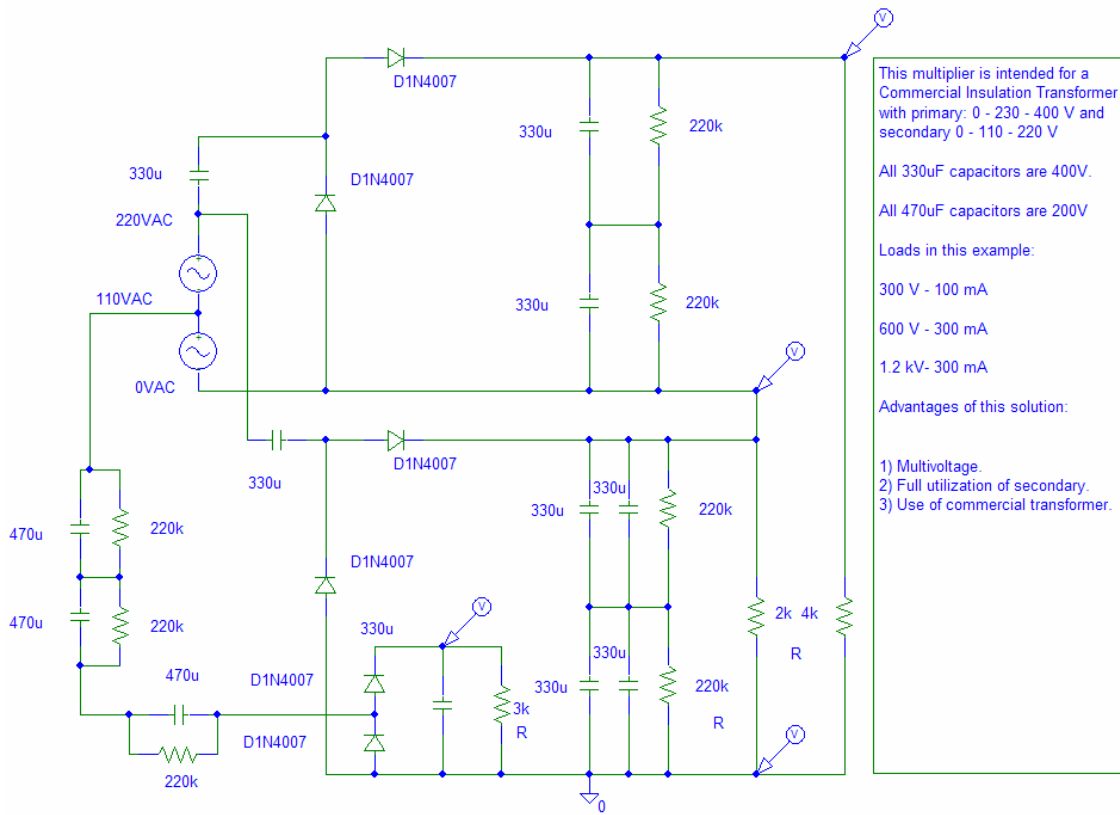


This is a better result, both for voltage drop and ripple, the number of capacitors is the same, or only an additional one for the improved design. It requires many more diodes, but they are very small and inexpensive.

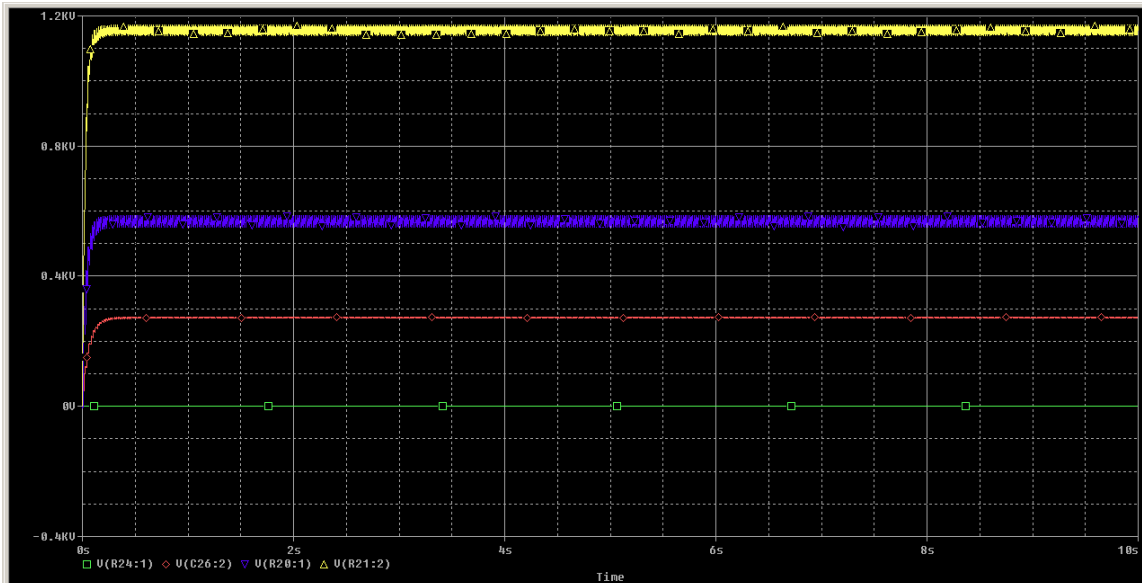
The full-wave Multi-voltage multiplier has the additional advantage that no DC current flows through the AC power source, instead the presence of a half-wave rectifier in the usual circuit causes a DC current flowing through the AC power source, which is an obvious drawback for most AC sources like iron or ferrite cored transformers, etc.

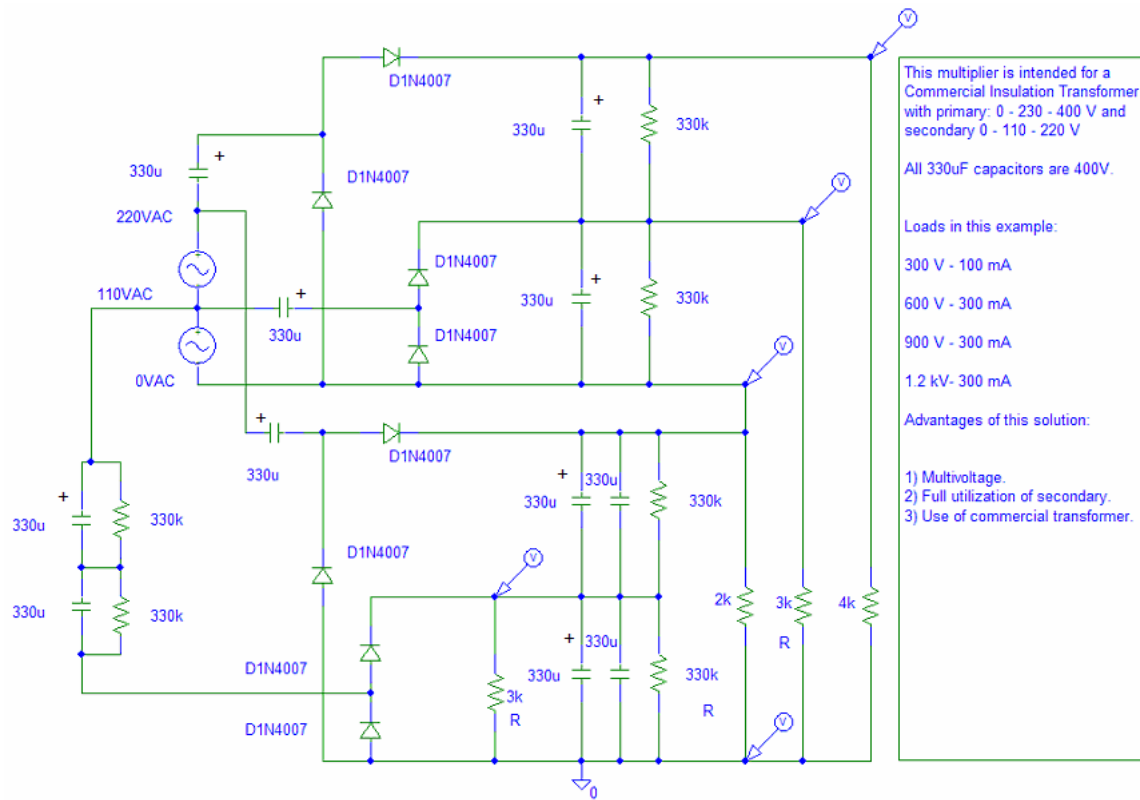
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# More on Multi-voltage Rectifiers.



That provides:





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