Duty Cycle

Our duty cycle controlled power is used in several of our products: our large Tesla coil, solid state Tesla coil, HHO power conditioner, large Jacob's ladder, induction heater, 100W CO2 laser, 1000A power supply, coil gun, black hole generator, and trigger/ignitor/shocker. It has many advantages over other methods of power distribution. When power is controlled by a variac or other voltage reducing mechanisms, output to the load decreases by Ohms Law where power = E x I, and the load sees a reduced voltage to control power. Both voltage and amps are simultaneously decreased as they are dependent functions on one another. An example is in attempting to dim a gas discharge tube such as a piece of neon or fluorescent tubing. As the voltage is decreased the tube dims to a point where now the gas discharge pulls from the ends, or extinguishes. Loads such as HHO reaction cells, corona or ozone production, paint spraying, flocking, or other chemical reactions suffer simultaneous voltage and current changing as dictated by the load resistance.

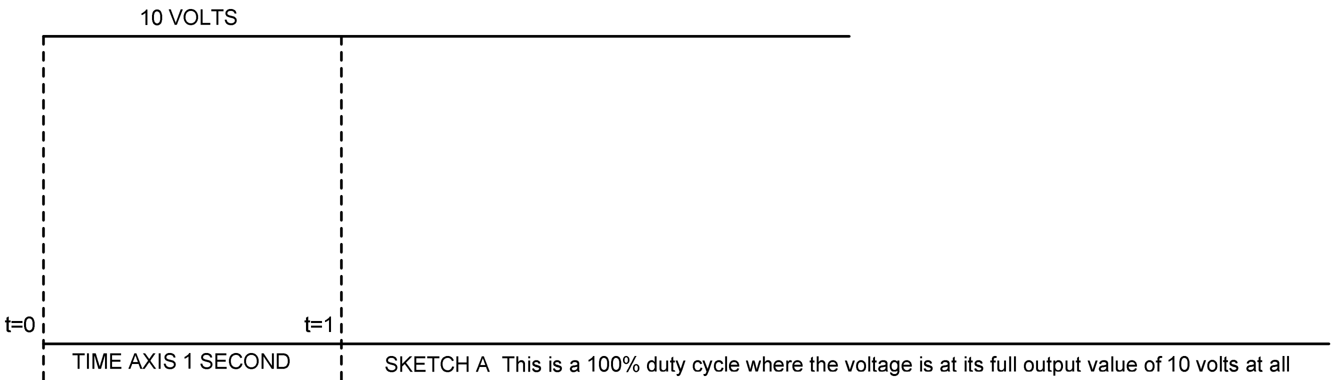
Duty cycled controlled power utilizes the time domain of the voltage. The waveform sketches show various ratios of the voltage wave form over a 1 second period. The sketch at A shows 10 volts at 100% "time on." The power produced in a 5 ohm resistor is simply volt squared divided by load resistance, in this case 10^2/5=20 watts. Sketch B shows a 50% "time on." One might think that the power is now 5 watts…but this is WRONG! For the 1-second period the voltage is discontinuous. It is 10 volts for half the 1 sec period and zero for the other half. The load sees full voltage and full current therefore full power of 20 watt for ½ sec. The energy for the one sec period is 10 joules. As the time "on" decreases the load still sees full power for the "on" interval, but now proportionately less energy in joules.

A plasma such as ionized neon gas in a long glass tube clearly shows this neat effect. The display can be reduced to a snake like thin line of energized plasma. The plasma would not pull from the ends of the discharge tube but would be obviously very dim. This is the result of very short full voltage pulses at corresponding current but much less joulean energy as energy = $\int vi(t)$

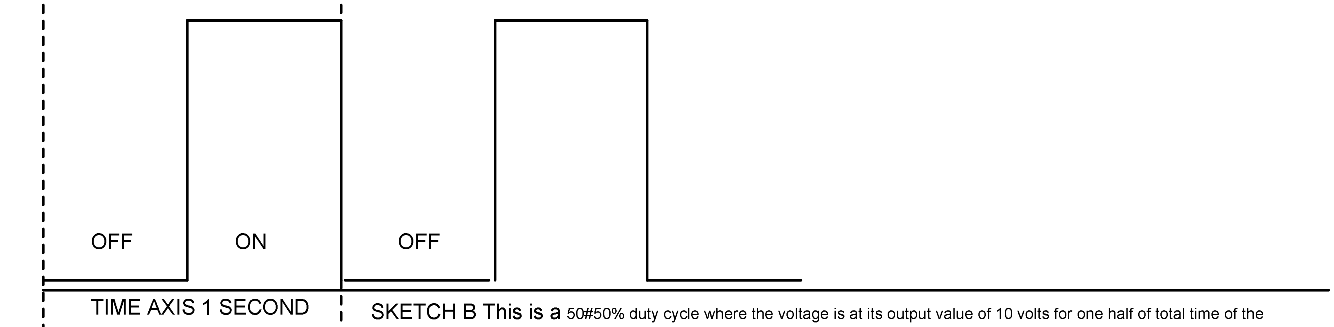
The load (if a gas discharge tube, solid state Tesla coil, HHO gas generator or those mentioned above) will now maintain the operational benefit of full voltage intervals but greatly reduced energy due to the shorter time "on".

If you dimmed the same tube by reducing the entire voltage time domain you would get dimming with display pulling away from the end electrodes and becoming very inhomogeneous. Other devices would function very erratically due the lack of voltage during the "on" time of the period.

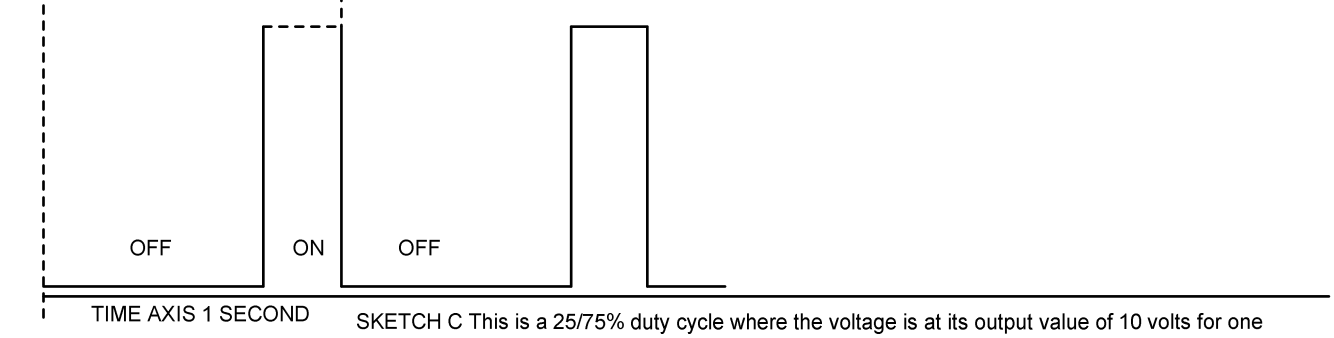
To summarize: you can control the power to a device by control of the current without reduction of the applied voltage. The device operates at normal voltage and current for a variable domain in time.



SKETCH A This is a 100% duty cycle where the voltage is at its full output value of 10 volts at all time of the period that has been selected as one second. Power to a 5 ohm resistor is 20 watts. The average current is 2 amps



SKETCH B This is a 50#50% duty cycle where the voltage is at its output value of 10 volts for one half of total time of the period that has been selected as one second. Note the other half the voltage is zero. The average current is 1 amp, power is 10 watts



SKETCH C This is a 25/75% duty cycle where the voltage is at its output value of 10 volts for one quarter of total time of the period that has been selected as one second. Note the other 75% of time the voltage is zero. The avarage current is .5 amps, power is 5 watts