Rectifier circuit design pdf

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What is a fix? Now we're adjacent to the most popular use of diode: correction. Simply put, a fix is the conversion of ac-force (SCT) into a straight current (DC). This includes a device that only allows one way to flow an electrical charge. As we've seen, that's exactly what a semiconductor diode does. The simplest type of fix chain is a semi-wave straightener. This allows only half of the AC wave to pass to the load. (Figure below) Semi-wave straightener chain. A semi-wave fix for most power applications, a half-wave fix isn't enough for the task. The harmonic content of the straightener output wave form is very large and therefore difficult to filter. In addition, the AC power source only supplies energy for loading half of each full cycle, which means that half of its power is not used. However, a semi-wave fix is a very simple way to reduce power to a resistor load. Some two position lamp dimmer switches apply full AC power to the lamp filament for full brightness and then semi-wave to fix it for a smaller light output. (picture below) Semi-wave application for fix: two-level dimmer lamp. At the Dim switch position, the incandescent bulb receives about half of the energy it normally receives from a full-wave air conditioner. Since the semi-wave corrected pulses power much faster than the thread has time to heat up and cool, the lamp does not blink. Instead, its thread simply works at a lower temperature than usual, providing less light. This principle of pulsating power of fast-reacting load devices to control the electrical energy sent to it is common in the world of industrial electronics. Since the control device (diode, in this case) either fully conducts or is completely non-conductive at any given time, it dissipates little heat energy, controlling the power load, which makes this method of power management very energy efficient. This scheme is perhaps the roughest possible power pulsation method for load, but this is sufficient as proof of the concept of the application. Full-wave rectifiers If we need to fix ac pump power to get full use of both semi-cycles of sinus wave, different configurations of chain fixes should be used. This is called a full-wave fix. One type of full-wave straightener, called the crane center design, uses a transformer with a central cooled secondary winding and two diodes, as in the image below. A full-wave straightener, a design with central flappings. Positive Half-Cycle Operation of this chain is easy to understand half a cycle at a time. Consider the first half of the cycle, when the polarity of the source's voltage is positive (I) from above and negative (-) at the bottom. Only the upper diode is held at this time; bottom diode blocks current, and load sees first half sinus wave, positive from above and negative at the bottom. Only the top half of the secondary winding transformer carries current during this half of the cycle, as in the picture below. Full-wave central press on the cleaner: The top half of the secondary winding holds during the positive half of the input cycle, providing a positive semi-cycle to load. Negative Half-Cycle During the next half of the cycle, the polarity of the AC changes. Now, another diode and the other half of the secondary winding transformer carry the current while parts of the chain previously hold the current during the last half of the cycle to sit back. The load still sees half of the sinus wave, the same polarity as before: positive from above and negative on the bottom. (Figure below) Full-wave central push straightener: During negative semi-cycle input, the lower half of the secondary winding conducts, providing a positive half cycle for the load. The drawbacks of full-wave rectifier design One drawback of this full-scale straightener design is the need for a transformer with a center tapped secondary winding. If the scheme in question has high power, the size and costs of a suitable transformer are significant. Consequently, the design of the crane center cleaner is observed only in low power applications. Other configurations of full-wave center polarity of the fictitious during load can be reversed by changing the direction of the diodes. In addition, reverse diodes can be parallel to the existing straightener with a positive result. The result is a double polarity full-wave center tapped cleaner in the picture below. Please note that the diodes themselves are connected by the same configuration as the bridge. The dual polarity of the full-wave crane center is the Full-Wave Bridge Rectifiers Another, more popular full-scale straightener design exists, and it is built around the bridge's four-diode configuration. For obvious reasons, this structure is called a full-wave bridge. (Figure below) Full-wave bridge fix. Current directions for the full-wave contour of the bridge straightener are shown in the image below for the positive cycle floor and the pattern below for the negative semi-cycles of the AC source wave shape. Note that regardless of the polarity of the input, the current flows in the same direction through the load. That is, the negative half-cycle of the source is a positive semi-cycle at load. The current stream passes through two diodes in a series for both polarities. Thus, two diode pressure drops of the source (0.7-2'1.4 V for Si) are lost in diodes. This is a disadvantage compared to the full-wave center crane design. This deficiency is only a problem in very low-voltage power sources. Full-wave bridge fix: flow for positive semi-cycles. Full-wave bridge fix: Current flow for negative semi-cycles. Alternative Full Wave Rectifier Chain Scheme Remembering the correct layout of diodes in the full-scale bridge bridge straightener chain often frustrates a new electronics student. I've found that an alternative representation of this chain is easier to both remember and understand. This is exactly the same pattern, except for all the diodes drawn horizontally, all pointing in the same direction. (Figure below) Alternative style of layout for a full-wave bridge straightener. A polyphasic version using an alternative layout One of the advantages of memorizing this layout for the bridge straightener chain is that it easily expands into the polyphase version in the picture below. Three-step full-wave scheme of the bridge straightener. Each three-p phase of the line is connected between a pair of diodes: one for route power in the positive (I) side of the load, and the other for the power route in the negative (-) side of the load. Polyphasic systems with more than three phases can easily fit into the bridge straightener scheme. Take, for example, the six-step scheme of the bridge straightener in the picture below. Six-step full-wave chain of the bridge straightener. When the polyphasic acfacier is corrected, the phase pulses overlap each other to produce a DC output that is much smoother (has less AC content) than the one that is produced by correcting the single-phase ac current. This is a clear advantage in high power fixes schemes, where the sheer physical size of the filtering components will be prohibitively high, but with low DC noise power to be obtained. The diagram below shows a full-wave fix of the three-step AC. Three-step ac mdy current and 3-phase output of full-wave straightener. Ripple Voltage In any case, the fixes - singlephase or polyphase - the amount of acme voltage mixed with the output of the DC straightener is called voltage ripples. In most cases, since pure DC is the desired target, ripple voltage is undesirable. If the power level is not too high, filtering networks can be used to reduce the amount of ripples in voltage output. 1-Pulse, 2-Pulse, and 6-Pulse units Sometimes, the correction method is mentioned by counting the number of DC pulses output for every 360o electric rotation. The single-vest phase, the semi-wave straightener chain, will then be called a 1-pulse straightener because it produces one pulse during one full cycle (360o) form of AC wave. A single phase, a full-wave straightener (regardless of the design, the center of the crane or the bridge) will be called a 2-pulse fictitious because it displays two DC pulses in one AC cycle worth of time. The three-step full-wave straightener will be called a 6-pulse block. Rectifier Circuit Phases Modern Electrical Engineering Convention further describes the function of the correction chain with three field notations of phases, paths and quantities The single-phase, semi-wave straightener chain is given a somewhat mysterious designation of 1Ph1W1P (phase 1, 1 method, 1 pulse), which means that the voltage of the AC current that the current at each phase of the AC supply lines only moves in one direction (path), and that there is one DC pulse produced for every 360o electrical rotation. The single-phase, full-wave, central straightener chain will be designated as 1Ph1W2P in this notation system: 1 phase, 1 current path or direction in each winding half, and two pulses or output voltage per cycle. The single-phase, full-wave, pavement cleaner will be designated as 1Ph2W2P: just as for the design of the crane center, except for current, can go both directions through the AC lines, not just one way. The three-phase bridge straightener scheme shown earlier will be called a 3Ph2W6P cleaner. The answer to this question is yes: especially in polyphasic schemes. Thanks to the creative use of transformers, full-wave straighteners can be parallel in such a way that more than six DC pulses are produced within three phases of AC. Phase 30o is introduced from the primary to the secondary threep phases of the transformer, when the winding configuration is not the same type. In other words, a transformer connected to either Y-I or Y will be exhibited, while a transformer connected to Y-Y or q-y will not. This phenomenon can be used by having one transformer connected to the Y-Y to feed the bridge straightener, and another transformer connected to the Y-I feed the second bridge straightener and then parallel the DC exits of both fixes. (figure below) As the wave waves of the waves of the two straighteners are phased 30o apart, their superposition results in less ripples than any straightener output seen separately: 12 pulses at 360o instead of just six: Polyphasic chain cleaner: 3-phase 2-way 12-pulse (3Ph2W12P) OVERVIEW: REORENCE is the conversion of AC to direct current (DC). A semi-wave straightener is a diagram that allows only half of the variable voltage wave cycle to be applied to the load, resulting in one deranged polarity. The resulting DC delivered to the load is significantly pulsing. A full-wave straightener is a circuit that converts both semis of the acquiesc cycle into a continuous series of voltage pulses of the same polarity. The resulting DC, delivered to the load, is not so much pulsing. Polyphasic ac variable current, when corrected, gives a much smoother wave form of DC (less ripples of voltage) than the corrected single-phase AC. 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