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Digital Load Adaptive Control for Resonant Inverter for Surface Metal Heating

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Abstract : Induction heating is a well-known technique to produce very high temperature at reduced time for well specific applications such as in melting steel, brazing, and hardening.Series resonant converter proves to suit better to surface metals treatment and hardening. Efficiency reaches its highest level in the resonant mode, where switching losses are minimized by operating the IGBT at a resonant frequency for switching at the zero crossing point of current or voltage.However, as heat rises during hardening metal process, the metal exhibits parameter variations, which ultimately affects the overall system performances. Therefore, the inverter system with an effective load-adaptive control circuit with short response time is highly sought to let the system operate efficiently regardless of any variation of the load parameters. This will bring back the system under resonant mode to allow the system to operate at its optimal performances. In this paper, an analysis of a series resonant inverter performance is conducted, in which the control frequency is monitored and continuously adapted using phase-locked loopaimed to metal hardening. The control technique is characterized by its flexibility, low cost hardware, and shortresponse time. The system comprises analogue and digital circuits, microcontroller based. The experimental bench is built for the purpose in the range of 1 to 5 kW power, with 01to 50 kHz operating frequency. First, the process principle and the design procedure of the inverter system with the proposed control scheme are described through modelling and simulation. Then, experimental results are presented to show the validity of this technique, and to evaluate the system performances

Keywords : Series resonant inverter, Load adaptive control