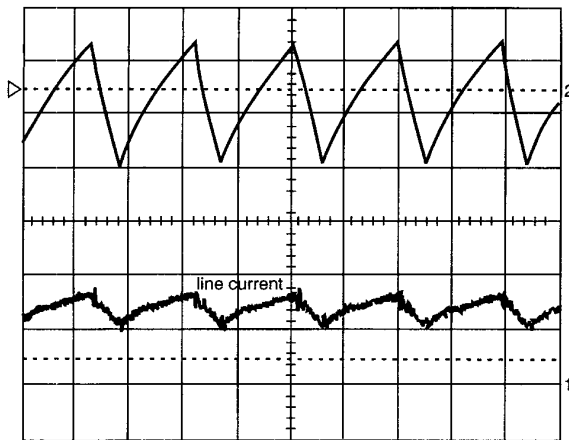


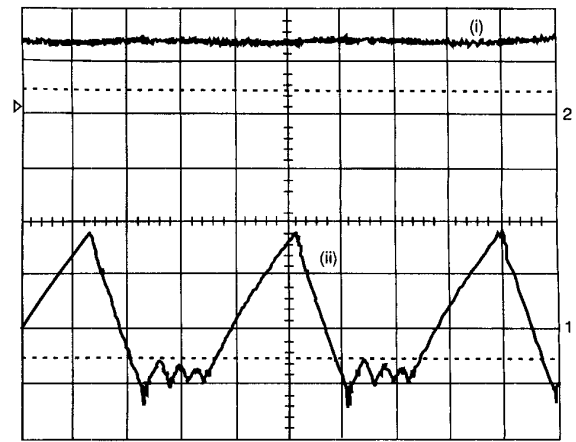
**Fig. 10** Line current and line voltage waveforms of 500 W uncoupled inductor Cuk converter  
 $V_m = 150\text{ V}$ ;  $V_o = 360\text{ V}$ ; current: 2 A/div; voltage: 70 V/div; time: 5 ms/div



**Fig. 11** Uncoupled inductor currents in a switching cycle  
 Secondary current 5 A/div; primary: 2 A/div; time: 10  $\mu\text{s}$ /div

## 6 Conclusions

The Cuk converter behaves as an automatic current waveshaper with no current control. Switching frequency harmonics can be reduced by coupling the two inductors as explained. Nonidealities inherent to PFR



**Fig. 12** Coupled-inductor currents in switching cycle  
 (i) Line current, (ii) secondary inductor current  
 Secondary current 5 A/div; primary 2 A/div; time 10  $\mu\text{s}$ /div

topologies are the lag effect in the input current at zero crossing and the switching harmonics. The switching harmonics are reduced by coupling the inductors. Another Cuk converter following this PFR stage can be designed for zero output ripple thus eliminating ripple from the input as well as the output. The lag effect is negligible as the inductance used is much smaller in the case of DCM. Further isolation can be given by introducing high-frequency transformer isolation. The transformer and the two inductors can be integrated into one magnetic structure and both the output and the input ripple can be transferred to the transformer where the AC ripple inherently exists as the magnetising current of the transformer

## 7 References

- BRKOVIC, M., and CUK, S.: 'Input current shaper using Cuk converter', *Proc. IEEE*, 1992, pp. 5532-5539
- SEBASTIAN, J., COBOS, J.A., LOPERA, J.M., and UCEDA, J.: 'The determination of boundaries between continuous and discontinuous conduction mode in PWM DC-to-DC converters used as power factor preregulators', *IEEE Trans. Power Electron.*, 1995, **10**, (5)
- LIU, K.H., and LIN, Y.L.: 'Current waveform distortion in power factor correction circuits employing discontinuous mode boost converters', *Proceedings of IEEE PESC*, pp. 780-791
- CUK, S.: 'Coupled inductor and integrated magnetics techniques in power electronics', *Proceedings of IECE, Japan*, 1983, pp. 347-352