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Extremal harmonic active control of power

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The extremal harmonic active control of power consists to define an energetic criterion at the main harmonic and to extremalize it on-line by commanding a secondary source of power. The term extremal means that the optimal criterion value is reached with an on-line optimization algorithm. Without loss of originality, the context of rotating machines oscillation in synchronization with rotor position is used to illustrate this approach. A second commanded torque source, attached to the shaft, is used to control speed oscillation due to torque disturbance. Such configuration can be found in hybrid automotive for example. The energetic criterion can be the kinetic energy (for conventional active speed oscillation cancelling), the reactive power (to add a virtual flywheel on the shaft) or the active power (for energy harvesting to charge a battery). The optimization algorithm is the method of steepest descent implemented with implicit or explicit gradient computation. But, in the case of reactive power, the implicit controller is not practically achievable. The experimental results with a test bed show that the explicit controllers converge at the extremum of each criterion. To conclude, the presented explicit extremal controller is a good candidate to be used for energetic criterion control.