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Design of Shunt Electric Networks in View of Sound Absorption with Loudspeakers

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Variable acoustic properties can be obtained at the diaphragm of a loudspeaker, with the help of very basic control strategies, among which is the simple electrical shunting of the transducer. These shunt techniques have been demonstrated to present singular similarities with active acoustic feedback strategies, dedicated to the control of the acoustic impedance of the loudspeaker. Based on this observation, an interesting strategy has been developped, intending at designing electric networks which, when connected to the loudspeaker, can make the latter reach a desired acoustic impedance over a certain frequency badnwidth. This paper presents a methodology for designing electric networks, that can be either passive or active, capable of achieving variable sound absorption at the loudspeaker diaphragm. In a first part, the theory underlying the concept of "electroacoustic absorber" is provided, highlighting formal equivalences between shunt and active feedback control, especially through the introduction of equivalent electric networks that mimic the performances of acoustic feedbacks. Simulated acoustic performances are presented, followed by discussions on the design of active electric shunts in view of active sound absorption. At last, experimental assessments of the studied configurations are presented, with general discussions on the potential improvements and applications

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