

# AUTOMATIC EQUALIZATION FOR IN-CAR COMMUNICATION SYSTEMS

*Philipp Bulling<sup>1</sup>, Klaus Linhard<sup>1</sup>, Arthur Wolf<sup>1</sup>, Gerhard Schmidt<sup>2</sup>*

*<sup>1</sup>Daimler AG, <sup>2</sup>Kiel University  
philipp.bulling@daimler.com*

**Abstract:** An automatic equalization filter for in-car communication (ICC) systems is presented. The filter aims at equalizing the sound, radiated from one or more loudspeakers, at the listener's position in order to achieve a better sound experience. Therefore, a microphone with a linear frequency response is placed close to the listener's ears in the car ceiling. To obtain a white frequency response at the listener's position, the loudspeaker signal must be equalized with the inverse frequency response of the coupling between the loudspeakers and the microphone. The coupling is described by the impulse response and it is estimated by means of an adaptive filter in this work. To design the equalization filter, the frequency response of the adaptive filter is used. The target applications are speech applications operating in a closed electro-acoustic loop, such as ICC-systems. Both simulations and tests in a real car show that the proposed automatic equalization filter improves speech quality in terms of a natural sounding system.