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Directivity control with Wave Field Synthesis: implications for live music performances

Terence Caulkins^a, Etienne Corteel^b, Joseph Sanson^c and Olivier Warusfel^c

^aArup, 155 Ave of the Americas, New York, NY 10013, USA

^bSonic Emotion, Eichweg, 6, CH-8154 Oberglatt, Switzerland

^cIRCAM, 1 Place Igor Stravinsky, 75004 Paris, France

Loudspeaker room interaction has a large impact on the perception of surround sound, especially in the context of "mixed concert", in which a loudspeaker system is used to synthesize virtual instruments that share the acoustic space of the stage with real musicians. Loudspeakers excite the listening environment in a way that differs from real instruments since, by design, they tend to exhibit constant directivity characteristics as a function of frequency. Moreover, real instruments exhibit radiation patterns that vary according to pitch, fingering and expressive movements. We present an approach based on Wave Field Synthesis which enables a control of radiation properties of the loudspeaker system which can be dynamically monitored in real time. Applications and potential perceptual impacts are discussed, focusing on the possibility of using directivity control to vary the excitation of the concert hall in order to monitor early reflections level and direct/reverberant energy ratio associated to virtual sources.