Fachgebiet Audiokommunikation

Prof. Dr. Stefan Weinzierl

Master Thesis

Geometrical Optimization of Loudspeaker Arrays using Generative Acoustics

Line source arrays (LSAs) are used for large-scale sound reinforcement aiming at sound fields that are as homogeneous as possible over the whole audio bandwidth. The deployed loudspeaker cabinets are rigged with different tilt angles and/or are electronically controlled in order to provide the intended coverage of the audience zones and to avoid radiation towards reflective ceilings, sidewalls or residential areas. An optimized geometric LSA curving shall be developed in this thesis, as a prerequisite for subsequent electronic wavefront shaping.

The polygonal audience line curving (PALC) [1] algorithm and its enhancements [3,4] will be extended by a genetic acoustics algorithm (GA). The solution of the genetic algorithm is based on a random initial population that is continuously mutated so that the target function is ideally fulfilled in the best case [2]. In this work, the implemented algorithm should be able to match a target sound pressure level distribution over the receiver area. Genetic algorithms are available, e.g., https://pymoo.org/. The results will be compared with an existing heuristic optimization of PALC [4]. Finally, the implemented GA can be incorporated into the exisiting bokeh GUI (http://bokeh.org/) of PALC [5].

Literature

[1]   Straube, F.; Schultz, F.; Albanes Bonillo, D.; Weinzierl, S. (2018): "An analytical approach for optimizing the curving of line source arrays". J. Audio Eng. Soc, 66(1/2):4–20.

[2]   Deb, K.; Pratap, A.; Agarwal, S und Meyarivan, T: „A fast and elitist multiobjective genetic algorithm: NSGA-II", IEEE Trans. Evol. Computat., Bd. 6, Nr. 2, S. 182–197, Apr. 2002.

[3]   Hölter, A.; Straube, F.; Schultz, F.;Weinzierl, S. (2021): "Enhanced Polygonal Audience Line Curving for Line Source Arrays" In: 150th Audio Engineering Society Convention, Paper 10451, online.

[4]   Hölter, A.; Straube, F.; Schultz, F.; Weinzierl, S. (2021): "SPL-basierte Optimierung der Krümmung von Line-Source-Arrays mit PALC".
URL: https://depositonce.tu-berlin.de/items/42f8ec25-3a16-4872-8d40-955c67df6b8d

[5]   Hölter, A.; Straube, F.; Schultz, F.; Weinzierl, S. (2020): "Eine Web-Applikation zur Optimierung der Krümmung von Line Source Arrays" In: Fortschritte der Akustik: Tagungsband d. 46. DAGA, 1161–1164, Hannover.

Requirements

Knowledge of acoustics. Programming knowledge, preferably in Python. Basic Linux knowledge.

Supervision

Arne Hölter,   hoelter@campus.tu-berlin.de
Artur Paszkiewicz,   a.paszkiewicz@tu-berlin.de
Dr. Florian Straube,
Prof. Dr. Stefan Weinzierl,   stefan.weinzierl@tu-berlin.de