

List of Publications

Lauri Savioja, D.Sc.(Tech.)

A. Peer-reviewed scientific articles

- [1] F. Stevens, D. T. Murphy, L. Savioja, and V. Valimäki, ‘Modeling sparsely reflecting outdoor acoustic scenes using the waveguide web,’ *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 25, pp. 1566–1578, aug 2017.
- [2] J. Saarelma and L. Savioja, ‘Audibility of dispersion error in room acoustic finite-difference time-domain simulation in the presence of absorption of air,’ *The Journal of the Acoustical Society of America*, vol. 140, pp. EL545–EL550, dec 2016.
- [3] P. Chobeau and L. Savioja, ‘Memory cost of absorbing conditions for the finite-difference time-domain method,’ *The Journal of the Acoustical Society of America*, vol. 140, pp. EL119–EL124, jul 2016.
- [4] P. Chobeau, S. Prepelit, J. Saarelma, J. Botts, and L. Savioja, ‘Finite volume time domain simulations of frequency-dependent boundary conditions and absorbing layer,’ in *Proc. AES 60th International conference*, (Leuven, Belgium), 2016.
- [5] V. Välimäki, J. Parker, L. Savioja, J. O. Smith, and J. Abel, ‘More than 50 years of artificial reverberation,’ in *Proc. AES 60th International conference*, (Leuven, Belgium), pp. K–1, Audio Engineering Society, jan 2016.
- [6] S. Prepelit, M. Geronazzo, F. Avanzini, and L. Savioja, ‘Influence of voxelization on finite difference time domain simulations of head-related transfer functions,’ *The Journal of the Acoustical Society of America*, vol. 139, pp. 2489–2504, may 2016.
- [7] J. Saarelma, J. Botts, B. Hamilton, and L. Savioja, ‘Audibility of dispersion error in room acoustic finite-difference time-domain simulation as a function of simulation distance,’ *The Journal of the Acoustical Society of America*, vol. 139, pp. 1822–1832, apr 2016.
- [8] S. Bilbao, B. Hamilton, J. Botts, and L. Savioja, ‘Finite volume time domain room acoustics simulation under general impedance boundary conditions,’ *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 24, pp. 161–173, jan 2016.
- [9] L. Savioja and U. P. Svensson, ‘Overview of geometrical room acoustic modeling techniques,’ *The Journal of the Acoustical Society of America*, vol. 138, pp. 708–730, aug 2015.
- [10] J. Botts and L. Savioja, ‘Extension of a spectral time-stepping domain decomposition method for dispersive and dissipative wave propagation,’ *The Journal of the Acoustical Society of America*, vol. 137, pp. EL267–EL273, apr 2015.
- [11] K. Saksela, J. Botts, and L. Savioja, ‘Optimization of absorption placement using geometrical acoustic models and least squares,’ *The Journal of the Acoustical Society of America*, vol. 137, pp. EL274–EL280, apr 2015.
- [12] V. Välimäki, A. Franck, J. Ramo, H. Gamper, and L. Savioja, ‘Assisted listening using a headset: Enhancing audio perception in real, augmented, and virtual environments,’ *IEEE Signal Processing Magazine*, vol. 32, pp. 92–99, mar 2015.
- [13] J. Belloch, J. Parker, L. Savioja, A. Gonzalez, and V. Välimäki, ‘Dynamic range reduction of audio signals using multiple allpass filters on a GPU Accelerator,’ in *Proc. European Signal Processing Conf. (EU-SIPCO)*, (Lisbon, Portugal), p. WE.P3, 2014.

- [14] J. Botts and L. Savioja, ‘Spectral and pseudospectral properties of finite difference models used in audio and room acoustics,’ *IEEE/ACM Trans. on Audio, Speech, and Language Processing*, vol. 22, pp. 1403–1412, sep 2014.
- [15] J. Botts and L. Savioja, ‘Effects of sources on time-domain finite difference models,’ *The Journal of the Acoustical Society of America*, vol. 136, pp. 242–7, jul 2014.
- [16] S. Siltanen, P. Robinson, J. Saarelma, J. Pätynen, S. Tervo, L. Savioja, and T. Lokki, ‘Acoustic visualizations using surface mapping,’ *The Journal of the Acoustical Society of America*, vol. 135, pp. EL344–9, jun 2014.
- [17] J. Belloch, B. Bank, L. Savioja, A. Gonzalez, and V. Välimäki, ‘Multi-channel IIR filtering of audio signals using a GPU,’ in *2014 IEEE Int. Conf. on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 6692–6696, IEEE, may 2014.
- [18] P. Robinson, S. Siltanen, T. Lokki, and L. Savioja, ‘Concert hall geometry optimization with parametric modeling tools and wave-based acoustic simulations,’ *Building Acoustics*, vol. 21, no. 1, pp. 55–64, 2014.
- [19] D. Murphy, A. Southern, and L. Savioja, ‘Source excitation strategies for obtaining impulse responses in finite difference time domain room acoustics simulation,’ *Applied Acoustics*, vol. 82, pp. 6–14, aug 2014.
- [20] A. Southern, S. Siltanen, D. Murphy, and L. Savioja, ‘Room impulse response synthesis and validation using a hybrid acoustic model,’ *IEEE Trans. Audio Speech Lang. Process.*, vol. 21, no. 9, pp. 1940 – 1952, 2013.
- [21] J. Botts and L. Savioja, ‘Integrating finite difference schemes for scalar and vector wave equations,’ in *IEEE Int. Conf. Acoust., Speech, Signal Processing*, (Vancouver, BC, Canada), 2013.
- [22] S. Siltanen, A. Southern, and L. Savioja, ‘Finite-difference time domain method source calibration for hybrid acoustics modeling,’ in *IEEE Int. Conf. Acoust., Speech, Signal Processing*, (Vancouver, BC, Canada), 2013.
- [23] T. Lokki, A. Southern, S. Siltanen, and L. Savioja, ‘Acoustics of Epidaurus - studies with room acoustics modelling methods,’ *Acta Acustica united with Acustica*, vol. 99, no. 1, pp. 40–47, 2013.
- [24] A. Southern, D. Murphy, and L. Savioja, ‘Spatial encoding of finite difference time domain acoustic models for auralization,’ *IEEE Transactions on Audio, Speech and Language Processing*, vol. 20, no. 9, pp. 2420–2432, 2012.
- [25] A. Southern and L. Savioja, ‘Spatial high frequency extrapolation method for room acoustic auralization,’ in *Proc. Int. Conf. on Digital Audio Effects (DAFx-12)*, (York, UK), pp. 145–149, 2012.
- [26] S. Siltanen, T. Lokki, S. Tervo, and L. Savioja, ‘Modeling incoherent reflections from rough room surfaces with image sources,’ *The Journal of the Acoustical Society of America*, vol. 131, pp. 4606–14, jun 2012.
- [27] V. Välimäki, J. Parker, L. Savioja, J. O. Smith, and J. S. Abel, ‘Fifty years of artificial reverberation,’ *IEEE Trans. on Acoustics, Speech and Language Proc.*, vol. 20, no. 5, pp. 1421–1448, 2012.
- [28] L. Antani, A. Chandak, L. Savioja, and D. Manocha, ‘Interactive sound propagation using compact acoustic transfer operators,’ *ACM Trans. on Graphics*, vol. 31, no. 1, pp. 7:1—7:12, 2012.
- [29] R. Mehra, N. Raghuvanshi, L. Savioja, M. Lin, and D. Manocha, ‘An efficient GPU-based time domain solver for the acoustic wave equation,’ *Applied Acoustics*, vol. 73, no. 2, pp. 83–94, 2012.
- [30] S. Tervo, T. Lokki, and L. Savioja, ‘Maximum likelihood estimation of loudspeaker locations from room impulse responses,’ *Journal of the Audio Engineering Society*, vol. 59, no. 11, pp. 845–857, 2011.

- [31] R. Albrecht, T. Lokki, and L. Savioja, 'A mobile augmented reality audio system with binaural microphones,' in *Proc. Interacting with Sound Workshop: Exploring Context-Aware, Local and Social Audio Applications*, (Stockholm, Sweden), pp. 7–11, ACM New York, NY, USA, 2011.
- [32] L. Savioja, V. Välimäki, and J. O. Smith, 'Audio signal processing using graphics processing units,' *Journal of the Audio Engineering Society*, vol. 59, no. 1/2, pp. 3–19, 2011.
- [33] T. Lokki, J. Pätynen, S. Tervo, S. Siltanen, and L. Savioja, 'Engaging concert hall acoustics is made up of temporal envelope preserving reflections,' *J. Acoust. Soc. Am.*, vol. 129, no. 5, pp. EL223–EL228, 2011.
- [34] L. Savioja, 'Real-time 3D finite-difference time-domain simulation of low- and mid-frequency room acoustics,' in *Proc. Int. Conf. Digital Audio Effects*, (Graz, Austria), 2010.
- [35] M. Peltola, T. Lokki, and L. Savioja, 'Augmented reality audio for location-based games,' in *Proc. AES 35th International conference on Game Audio*, 2009.
- [36] S. Laine, S. Siltanen, T. Lokki, and L. Savioja, 'Accelerated beam tracing algorithm,' *Appl. Acoust.*, vol. 70, no. 1, pp. 172–181, 2009.
- [37] S. Siltanen, T. Lokki, and L. Savioja, 'Frequency domain acoustic radiance transfer for real-time auralization,' *Acta Acust. Acust.*, vol. 95, no. 1, pp. 106–117, 2009.
- [38] M. Noisternig, B. Katz, S. Siltanen, and L. Savioja, 'Framework for real-time auralization in architectural acoustics,' *Acta Acustica United with Acustica*, vol. 94, no. 6, pp. 1000–1015, 2008.
- [39] S. Siltanen, T. Lokki, L. Savioja, and C. L. Christensen, 'Geometry reduction in room acoustics modeling,' *Acta Acustica united with Acustica*, vol. 94, no. 3, pp. 410–418, 2008.
- [40] R. Ajaj, L. Savioja, and C. Jacquemin, 'Software platform for real-time audio-visual virtual reality,' in *ACM Virtual Reality Software and Technology*, (Bordeaux, France), 2008.
- [41] S. Bilbao, L. Savioja, and J. O. Smith, 'Parametrized finite difference schemes for plates: Stability, the reduction of directional dispersion and frequency warping,' *IEEE Transactions on Acoustics, Speech and Language Processing*, vol. 15, no. 14, pp. 1488–1495, 2007.
- [42] S. Siltanen, T. Lokki, S. Kiminki, and L. Savioja, 'The room acoustic rendering equation,' *J. Acoust. Soc. Am.*, vol. 122, no. 3, pp. 1624–1635, 2007.
- [43] A. Kelloniemi, P. Huang, V. Välimäki, and L. Savioja, 'Hyper-dimensional digital waveguide mesh for reverberation modeling,' in *Proc. 10th International Conference on Digital Audio Effects (DAFx-07)*, (Bordeaux, France), 2007.
- [44] A. Kelloniemi, V. Välimäki, and L. Savioja, 'Simulation of room acoustics using 2-D Digital Waveguide Meshes,' in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing*, vol. 5, 2006.
- [45] A. Kelloniemi, L. Savioja, and V. Välimäki, 'Spatial filter based absorbing boundary for the 2-D digital waveguide mesh,' *IEEE Signal Processing Letters*, vol. 12, no. 2, pp. 126–129, 2005.
- [46] A. Kelloniemi, V. Välimäki, P. Huang, and L. Savioja, 'Artificial reverberation using a hyper-dimensional FDTD mesh,' in *Proc. European Signal Processing Conf.*, 2005.
- [47] A. Kelloniemi, D. Murphy, L. Savioja, and V. Välimäki, 'Boundary conditions in a multi-dimensional digital waveguide mesh,' in *Proc. IEEE Int. Conf. Acoust. Speech Signal Processing*, (Montreal, Canada), pp. IV–25 – IV–28, 2004.

- [48] L. Savioja and V. Välimäki, 'Interpolated rectangular 3-D digital waveguide mesh algorithms with frequency warping,' *IEEE Trans. on Speech and Audio Processing*, vol. 11, no. 6, pp. 783–790, 2003.
- [49] M. Karjalainen, C. Erkut, and L. Savioja, 'Compilation of unified physical models for efficient sound synthesis,' in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing*, vol. V, (Hong Kong), pp. 433–436, 2003.
- [50] L. Savioja, M. Mantere, I. Olli, S. Äyräväinen, M. Gröhn, and J. Iso-aho, 'Utilizing virtual environments in construction projects,' *Electronic Journal of Information Technology in Construction*, vol. 8, Special, pp. 65–84, 2003.
- [51] L. Savioja, T. Lokki, and J. Huopaniemi, 'Interactive room acoustic rendering in real time,' in *Proc. IEEE Int. Conf. on Multimedia and Expo*, (Lausanne, Switzerland), pp. 497–500, 2002.
- [52] T. Lokki, L. Savioja, J. Huopaniemi, R. Väänänen, and T. Takala, 'Creating interactive virtual auditory environments,' *IEEE Computer Graphics and Applications*, vol. 22, no. 4, pp. 49–57, 2002.
- [53] T. Lokki, V. Pulkki, and L. Savioja, 'The effect of early reflections to perceived timbre - analyzed with an auditory model,' in *Proc. Int. Conf. Auditory Display (ICAD'2002)*, (Kyoto, Japan), pp. 320–325, 2002.
- [54] T. Lokki, P. Svensson, and L. Savioja, 'An efficient auralization of edge diffraction,' in *Proc. AES 21st Int. Conf. Architectural Acoustics and Sound Reinforcement*, (St. Petersburg, Russia), pp. 166–172, 2002.
- [55] M. Karjalainen, V. Ikonen, P. Antsallo, P. Maijala, L. Savioja, A. Suutala, and S. Pohjolainen, 'Comparison of numerical simulation models and measured low-frequency behavior of loudspeaker enclosures,' *Journal of the Audio Engineering Society*, vol. 49, no. 12, pp. 1148–1166, 2001.
- [56] F. Fontana, L. Savioja, and V. Välimäki, 'A modified rectangular waveguide mesh structure with interpolated input and output points,' in *Proc. Int. Computer Music Conf.*, (Havana, Cuba), pp. 87–90, 2001.
- [57] L. Savioja and V. Välimäki, 'Multiwarping for enhancing the frequency accuracy of digital waveguide mesh simulations,' *IEEE Signal Processing Letters*, vol. 8, no. 5, pp. 134–136, 2001.
- [58] L. Savioja and V. Välimäki, 'Interpolated 3-D Digital Waveguide Mesh with Frequency Warping,' in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing*, vol. 5, (Salt Lake City, UT), pp. 3345–3348, 2001.
- [59] V. Välimäki and L. Savioja, 'Interpolated and warped 2-D Digital Waveguide Mesh Algorithms,' in *COST G-6 Conf. Digital Audio Effects*, (Verona, Italy), pp. 201–206, 2000.
- [60] A. Härmä, M. Karjalainen, L. Savioja, V. Välimäki, U. K. Laine, and J. Huopaniemi, 'Frequency-warped signal processing for audio applications,' *Journal of the Audio Engineering Society*, vol. 48, no. 11, pp. 1011–1031, 2000.
- [61] T. Lokki, M. Gröhn, L. Savioja, and T. Takala, 'A case study of auditory navigation in virtual acoustic environments,' in *Proc. Int. Conf. Auditory Display (ICAD'2000)*, (Atlanta, Georgia), pp. 145–150, 2000.
- [62] J. Hiipakka, T. Ilmonen, T. Lokki, and L. Savioja, 'Sound signal processing for a virtual room,' in *Proc. European Signal Proc. Conf. (Eusipco'2000)*, (Tampere, Finland), pp. 2221–2224, 2000.
- [63] J. Huopaniemi, L. Savioja, T. Lokki, and R. Väänänen, 'Virtual acoustics - applications and technology trends,' in *Proc. European Signal Proc. Conf. (Eusipco'2000)*, (Tampere, Finland), pp. 2201–2208, 2000.
- [64] L. Savioja and V. Välimäki, 'Reducing the dispersion error in the digital waveguide mesh using interpolation and frequency-warping techniques,' *IEEE Transactions on Speech and Audio Processing*, vol. 8, no. 2, pp. 184–194, 2000.

- [65] L. Savioja, J. Huopaniemi, T. Lokki, and R. Väänänen, 'Creating interactive virtual acoustic environments,' *Journal of the Audio Engineering Society*, vol. 47, no. 9, pp. 675–705, 1999.
- [66] T. Lokki, J. Hiipakka, and L. Savioja, 'Immersive 3d sound reproduction in a virtual room,' in *Proc. AES 16th Int. Conf. on Spatial Sound Reproduction*, pp. 172–177, 1999.
- [67] L. Savioja and V. Välimäki, 'Reduction of the dispersion error in the triangular digital waveguide mesh using frequency warping,' *IEEE Signal Processing Letters*, vol. 6, no. 3, pp. 58–60, 1999.
- [68] L. Savioja and V. Välimäki, 'Reduction of the dispersion error in the interpolated digital waveguide mesh using frequency warping,' in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing*, vol. 2, (Phoenix, AZ), pp. 973–976, 1999.
- [69] T. Lokki, R. Väänänen, L. Savioja, and J. Huopaniemi, 'Advanced 3-D audio in an interactive multimedia environment,' in *Proc. IEEE Nordic Signal Processing Symp. (NORSIG'98)*, (Vigs{ø}, Denmark), pp. 201–204, 1998.
- [70] T. Lokki, J. Hiipakka, R. Hänninen, T. Ilmonen, L. Savioja, and T. Takala, 'Real-time audiovisual rendering and contemporary audiovisual art,' *Organised Sound*, vol. 3, no. 3, pp. 219–233, 1998.
- [71] J. Huopaniemi, L. Savioja, and M. Karjalainen, 'Modeling of reflections and air absorption in acoustical spaces a digital filter design approach,' in *Proc. IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA'97)*, p. 4, 1997.
- [72] L. Savioja, J. Huopaniemi, T. Lokki, and R. Väänänen, 'Virtual environment simulation - advances in the DIVA project,' in *Proc. Int. Conf. Auditory Display (ICAD'97)*, (Palo Alto, CA), pp. 43–46, 1997.
- [73] L. Savioja and V. Välimäki, 'Improved discrete-time modeling of multi-dimensional wave propagation using the interpolated digital waveguide mesh,' in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing*, vol. 1, (Munich, Germany), pp. 459–462, 1997.
- [74] L. Savioja, M. Karjalainen, and T. Takala, 'DSP Formulation of a Finite Difference Method for Room Acoustics Simulation,' in *Proc. IEEE Nordic Signal Processing Symp. (NORSIG'96)*, (Espoo, Finland), pp. 455–458, 1996.
- [75] L. Savioja and V. Välimäki, 'The bilinearly deinterpolated waveguide mesh,' in *Proc. IEEE Nordic Signal Processing Symp. (NORSIG'96)*, (Espoo, Finland), pp. 443–446, 1996.
- [76] L. Savioja, J. Huopaniemi, T. Huottilainen, and T. Takala, 'Real-time virtual audio reality,' in *Proc. Int. Computer Music Conf.*, (Hong Kong), pp. 107–110, 1996.
- [77] J. Huopaniemi, L. Savioja, and T. Takala, 'Diva virtual audio reality system,' in *Proc. Int. Conf. Auditory Display (ICAD'96)*, (Palo Alto, CA), pp. pp. 111–116, 1996.
- [78] R. Hänninen, L. Savioja, and T. Takala, 'Virtual concert performance - synthetic animated musicians playing in an acoustically simulated room,' in *Proc. Int. Computer Music Conf.*, (Hong Kong), pp. 402–404, 1996.
- [79] L. Savioja, T. Rinne, and T. Takala, 'Simulation of room acoustics with a 3-D finite difference mesh,' in *Proc. Int. Computer Music Conf.*, (Aarhus, Denmark), pp. 463–466, 1994.

B. Non-refereed scientific articles

- [1] A. Meacham, L. Savioja, S. R. Martin, and J. O. Smith, III, ‘Digital waveguide network reverberation in non-convex rectilinear spaces,’ in *141th Audio Engineering Society Convention*, (Los Angeles, CA), Audio Engineering Society, sep 2016.
- [2] L. Savioja, J. Saarelma, and J. Botts, ‘Challenges in measurement of performance of an acoustics simulation,’ in *Forum Acusticum*, (Krakow, Poland), p. SS17.2, 2014.
- [3] J. Saarelma and L. Savioja, ‘An open source finite-difference time-domain solver for room acoustics using graphics processing units,’ in *Forum Acusticum*, (Krakow, Poland), p. SS11.8, 2014.
- [4] P. Luizard, M. Otani, J. Botts, L. Savioja, and B. Katz, ‘Comparison of sound field measurements and predictions in coupled volumes between numerical methods and scale model measurements,’ in *21st International Congress on Acoustics*, (Montreal, Canada), 2013.
- [5] P. Robinson, S. Siltanen, T. Lokki, and L. Savioja, ‘Concert hall geometry optimization with parametric modeling tools and wave-based acoustic simulations,’ in *International Symposium on Room Acoustics (ISRA 2013)*, (Toronto, Canada), 2013.
- [6] P. Robinson, T. Lokki, A. Kuusinen, J. Pätynen, S. Tervo, and L. Savioja, ‘Auditory spatial resolution studies in the helsinki music centre,’ in *Proc. Internoise*, (New York, USA), 2012.
- [7] T. Lokki, A. Southern, S. Siltanen, and L. Savioja, ‘Studies of epidaurus with a hybrid room acoustics modeling method,’ in *EAA Conference on the Acoustics of Ancient Theaters*, (Patras, Greece), 2011.
- [8] T. Lokki, A. Southern, and L. Savioja, ‘Studies on seat-dip effect with 3D FDTD modeling,’ in *Forum Acusticum*, (Aalborg, Denmark), 2011.
- [9] A. Southern, D. Murphy, T. Lokki, and L. Savioja, ‘The perceptual effects of dispersion error on room acoustic model auralization,’ in *Proc. Forum Acusticum*, (Aalborg, Denmark), pp. 1553–1558, 2011.
- [10] A. Southern, S. Siltanen, and L. Savioja, ‘Spatial room impulse responses with a hybrid modeling method,’ in *Proc. 130th Audio Eng. Soc. Conv., preprint no. 8385*, (London, UK), 2011.
- [11] S. Siltanen, T. Lokki, and L. Savioja, ‘Efficient acoustic radiance transfer method with time-dependent reflections,’ in *Proc. of Meetings on Acoustics – 161st Meeting Acoustical Society of America*, vol. 12, (Seattle, Washington, USA), p. 15007, 2011.
- [12] L. Savioja, D. Manocha, and M. Lin, ‘Use of GPUs in room acoustic modeling and auralization,’ in *Proc. Int. Symp. Room Acoustics*, (Melbourne, Australia), 2010.
- [13] S. Siltanen, T. Lokki, and L. Savioja, ‘Rays or waves? understanding the strengths and weaknesses of computational room acoustics modeling techniques,’ in *Proc. Int. Symposium on Room Acoustics*, (Melbourne, Australia), 2010.
- [14] S. Siltanen, T. Lokki, and L. Savioja, ‘Room acoustics modeling with acoustics radiance transfer,’ in *Proc. Int. Symposium on Room Acoustics*, (Melbourne, Australia), 2010.
- [15] L. Savioja, V. Välimäki, and J. O. Smith, ‘Real-time additive synthesis with one million sinusoids using a GPU,’ in *the AES 128th International Convention*, (London, UK), 2010.
- [16] L. Savioja, ‘3D Audio in Virtual Environments,’ in *Proc. EuroVR-EVE*, (Paris, France), 2010.
- [17] T. Lokki and L. Savioja, ‘State-of-the-art in auralization of concert hall models – what is still missing?,’ in *Baltic-Nordic Acoustics Meeting*, (Reykjavik, Iceland), 2008.

- [18] M. Noisternig, L. Savioja, and B. Katz, 'Real-time auralization system based on beam-tracing and mixed-order ambisonics,' in *Acoustics'08*, (Paris, France), 2008.
- [19] R. Kajastila, S. Siltanen, P. Lunden, T. Lokki, and L. Savioja, 'A distributed real-time virtual acoustic rendering system for dynamic geometries,' in *the AES 122th International Convention, paper nr. 7160*, (Vienna, Austria), 2007.
- [20] S. Siltanen, T. Lokki, and L. Savioja, 'Acoustic radiance transfer method for room acoustic modeling,' in *Proc. 19th Int. Congr. Acoust. (ICA'07)*, (Madrid, Spain), 2007.
- [21] R. Kajastila, T. Lokki, and L. Savioja, 'Interactive multi-channel auralization with camera-based tracking,' in *Proc. 19th Int. Congr. Acoust. (ICA'07)*, (Madrid, Spain), 2007.
- [22] S. Siltanen, T. Lokki, and L. Savioja, 'Geometry reduction in room acoustics modeling,' in *Proc. Sixth Int. Conf. On Auditorium Acoustics*, (Copenhagen, Denmark), 2006.
- [23] T. Lokki and L. Savioja, 'Evaluation of auralization results,' in *Proc. Forum Acusticum*, (Budapest, Hungary), 2005.
- [24] T. Takala, L. Savioja, and T. Lokki, 'Swimming in a virtual aquarium.' Presentation in the 6th International Workshop on Gesture in Human-Computer Interaction and Simulation, (Vannes, France), May, 2005.
- [25] T. Lokki, H. Nironen, S. Vesa, L. Savioja, A. Härmä, and M. Karjalainen, 'Application scenarios of wearable and mobile augmented reality audio,' in *the 116th Audio Engineering Society (AES) Convention, preprint no. 6026*, (New York, USA), 2004.
- [26] L. Savioja, A. Kelloniemi, V. Välimäki, and D. Murphy, 'Current state of research on boundary conditions in the digital waveguide mesh,' in *Proc. of 18th Int. Congress on Acoustics*, (Kyoto, Japan), pp. 477–478, 2004.
- [27] T. Lokki, H. Nironen, S. Vesa, L. Savioja, and A. Härmä, 'Problem of far-end user's voice in binaural telephony,' in *Proc. of 18th Int. Congress on Acoustics*, (Kyoto, Japan), pp. 1001–1004, 2004.
- [28] M. Laakso, L. Repokari, and L. Savioja, 'Speech related navigation - a challenge for human-computer interaction?,' in *Proc. of the XVth Triennial Congress of the International Ergonomics Association*, (Seoul, South Korea), 2003.
- [29] L. Savioja and V. Välimäki, 'Interpolated 3-D Digital Waveguide Mesh for Room Acoustic Simulations,' in *Proc. of Forum Acusticum 2002*, vol. NUM-02-002, (Sevilla, Spain), 2002.
- [30] T. Lokki and L. Savioja, 'A flexible framework for parametric auralization,' in *Joint Baltic-Nordic Acoustical Meeting*, (Lyngby, Denmark), 2002.
- [31] L. Savioja, T. Lokki, and V. Välimäki, 'The interpolated 3-D digital waveguide mesh method for room acoustic simulation and auralization,' in *Joint Baltic-Nordic Acoustical Meeting*, (Lyngby, Denmark), 2002.
- [32] L. Savioja, T. Lokki, and J. Huopaniemi, 'Auralization applying the parametric room acoustic modeling technique - the diva auralization system,' in *Proc. Int. Conf. Auditory Display (ICAD'2002)*, (Kyoto, Japan), pp. 219–224, 2002.
- [33] V. Pulkki, T. Lokki, and L. Savioja, 'Implementation and visualization of edge diffraction with image-source method,' in *the 112nd Audio Engineering Society (AES) Convention, preprint no. 5603*, (Munich, Germany), 2002.
- [34] P. Svensson, L. Savioja, T. Lokki, and U. Kristiansen, 'Low-frequency models for room acoustic prediction,' in *Proc. 17th International Congress on Acoustics*, (Rome, Italy), p. 7B.09.03, 2001.

- [35] M. Gröhn, T. Lokki, and L. Savioja, ‘Using binaural hearing for localization in multimodal virtual environments,’ in *Proc. 17th International Congress on Acoustics*, (Rome, Italy), p. 4P.32, 2001.
- [36] M. Gröhn, M. Mantere, L. Savioja, and T. Takala, ‘3d visualization of building services in virtual environment,’ in *Proc. 17th Conference on Education in Computer Aided Architectural Desing in Europe*, pp. 523–528, 2001.
- [37] T. Lokki, J. Hiipakka, and L. Savioja, ‘A framework for evaluating virtual acoustic environments,’ in *the 110th Audio Engineering Society (AES) Convention, preprint no. 5317*, (Amsterdam, the Netherlands), 2001.
- [38] J. Hiipakka, T. Ilmonen, T. Lokki, M. Gröhn, and L. Savioja, ‘Implementation issues of 3D audio in a virtual room,’ in *Proc. 13th Symposium of IS&T/SPIE, Electronic Imaging 2001*, vol. 4297B, (San Jose, California, USA), 2001.
- [39] M. Gröhn, T. Lokki, L. Savioja, and T. Takala, ‘Some aspects of role of audio in immersive visualization,’ in *Proc. 13th Symposium of IS&T/SPIE, Electronic Imaging 2001*, vol. 4302B, (San Jose, California, USA), 2001.
- [40] A. Härmä, M. Karjalainen, L. Savioja, V. Välimäki, U. K. Laine, and J. Huopaniemi, ‘Frequency-warped signal processing for audio applications (aes convention),’ in *the 108th Audio Engineering Society (AES) Convention, preprint no. 5171*, (Paris, France), p. 42 p., 2000.
- [41] T. Lokki, L. Savioja, J. Huopaniemi, R. Hänninen, T. Ilmonen, J. Hiipakka, V. Pulkki, R. Väänänen, and T. Takala, ‘Virtual concerts in virtual spaces - in real time,’ in *Joint ASA/EAA Meeting*, (Berlin, Germany), 1999.
- [42] L. Savioja, ‘Improving the three-dimensional digital waveguide mesh by interpolation,’ in *Proc. Nordic Acoustical Meeting*, (Stockholm, Sweden), pp. 265–268, 1998.
- [43] M. Karjalainen, V. Ikonen, A. Järvinen, P. Maijala, L. Savioja, A. Suutala, J. Backman, and S. Pohjolainen, ‘Comparison of numerical simulation models and measured low-frequency behavior of a loudspeaker,’ in *the 104th Audio Engineering Society (AES) Convention, preprint no. 4722*, (Amsterdam, the Netherlands), 1998.
- [44] A. Järvinen, L. Savioja, H. Möller, V. Ikonen, and A. Ruusuvoori, ‘Design of a reference listening room—a case study,’ in *the 103th Audio Engineering Society (AES) Convention, preprint no. 4559*, (New York, NY), 1997.
- [45] R. Hänninen, L. Savioja, and T. Takala, ‘Virtual concert performance - synthetic animated musicians playing in an acoustically simulated room,’ in *Enabling Network-Based Learning Conference*, (Espoo, Finland), 1997.
- [46] L. Savioja, A. Järvinen, K. Melkas, and K. Saarinen, ‘Determination of the low frequency behavior of an IEC Listening Room,’ in *Proc. Nordic Acoustical Meeting*, (Helsinki, Finland), pp. 55–58, 1996.
- [47] J. Huopaniemi, L. Savioja, T. Huutilainen, and T. Takala, ‘Implementation of a virtual audio reality system,’ in *Proc. Nordic Acoustical Meeting*, (Helsinki, Finland), pp. 331–338, 1996.
- [48] T. Takala, R. Hänninen, V. Välimäki, L. Savioja, J. Huopaniemi, T. Huutilainen, and M. Karjalainen, ‘An integrated system for virtual audio reality,’ in *Proc. 100th Audio Eng. Soc. Conv., preprint no. 4229*, (Copenhagen, Denmark), 1996.
- [49] L. Savioja, J. Backman, A. Järvinen, and T. Takala, ‘Waveguide mesh method for low-frequency simulation of room acoustics,’ in *Proc. 15th Int. Congr. Acoust. (ICA’95)*, vol. 2, (Trondheim, Norway), pp. 637–640, 1995.

C. Special issues of a journal

- [1] L. Savioja, A. Ando, R. Duraiswami, E. Habets, and S. Spors, ‘Editorial: Introduction to the issue on spatial audio,’ *IEEE Journal of Selected Topics in Signal Processing*, vol. 9, no. 5, pp. 767–769, 2015.
- [2] V. Välimäki, A. Sarti, M. Karjalainen, R. Rabenstein, and L. Savioja, ‘Editorial: Special issue on model-based sound synthesis,’ *EURASIP Journal on Applied Signal Processing*, vol. 2004, no. 7, pp. 923–925, 2004.

D. Publications intended for professional communities

- [1] P. Svensson, J. Botts, and L. Savioja, ‘Computational modeling of room acoustics i: Wave-based modeling,’ in *Architectural Acoustics Handbook* (N. Xiang, ed.), ch. 1, J. Ross Publishing, 2017.
- [2] P. Svensson, S. Siltanen, L. Savioja, and N. Xiang, ‘Computational modeling of room acoustics ii: Geometrical acoustics,’ in *Architectural Acoustics Handbook* (N. Xiang, ed.), ch. 2, J. Ross Publishing, 2017.
- [3] L. Savioja, ‘GPUs for DAFx.’ Tutorial on DAFx’12 conference, York, UK, September, 2012.
- [4] D. Manocha, L. Savioja, M. Lin, N. Tsingos, and P. Calamia, ‘Interactive sound rendering.’ Course in the Siggraph 2009 conference, New Orleans, USA, 2009.
- [5] T. Lokki and L. Savioja, ‘Virtual acoustics,’ in *Handbook of Signal Processing in Acoustics*, Springer Verlag, 2008.
- [6] T. Lokki and L. Savioja, ‘Room acoustics modeling.’ Tutorial given at the 124th AES Convention, Amsterdam, the Netherlands, 2008.
- [7] A. Kelloniemi and L. Savioja, ‘Implementation of boundary conditions in digital waveguide mesh (in Finnish).’ Akustiikkapäivät, 2003.
- [8] L. Savioja and T. Lokki, ‘Digital waveguide mesh for room acoustic modeling,’ in *ACM Siggraph Campfire: Acoustic Rendering for Virtual Environments*, (Snowbird, UT), 2001.
- [9] T. Lokki and L. Savioja, ‘The DIVA auralization system,’ in *ACM Siggraph Campfire: Acoustic Rendering for Virtual Environments*, (Snowbird, UT), 2001.
- [10] T. Lokki and L. Savioja, ‘Current trends in room acoustic modeling and auralization (in Finnish).’ Akustiikkapäivät, 2001.
- [11] L. Savioja, T. Lokki, and M. Gröhn, ‘Auditory displays in virtual rooms.’ Tutorial in Int. Conf. Auditory Display (ICAD’2001), 2001.
- [12] H. Möller, T. Peltonen, L. Savioja, T. Lokki, and B. Gouatarbes, ‘The development of new strategies in room acoustic measurements,’ in *Proceedings NAM*, 2000.
- [13] L. Savioja and V. Välimäki, ‘Progress in modeling of multidimensional wave propagation (in Finnish).’ Akustiikkapäivät, 1999.
- [14] L. Savioja, ‘Creating interactive virtual acoustic environments (presentation).’ The 1st meeting of the EAA Technical committee Room and Building Acoustics in Braunschweig, Germany, 1999.
- [15] T. Lokki and L. Savioja, ‘Implementation of an auralization demonstration (in Finnish).’ Akustiikkapäivät, 1997.

G. Theses

- [1] L. Savioja, *Modeling Techniques for Virtual Acoustics*. PhD thesis, Helsinki University of Technology, Telecommunications Software and Multimedia Laboratory, 1999.
- [2] L. Savioja, 'Computational modeling of room acoustics.' Licentiate Thesis, Helsinki University of Technology, 1995.
- [3] L. Savioja, *Implementation of a Message Browsing Workstation in Motif-environment*. Master's Thesis, Helsinki University of Technology, 1991.

H. Patents

- [1] J. Hiipakka, T. Lokki, and L. Savioja, 'Menetelmä kaikulaitteessa ja kaikulaite.' Finnish Patent FI 111571 B, 2003.

I. Audiovisual material, ICT software

- [1] L. Savioja, 'SoundRad - 2D room acoustic modeling utility for educational purposes.' <http://auralization.tkk.fi/{SoundRad}>, 2009.
- [2] S. Siltanen, L. Savioja, and M. Noisternig, 'EVERTims, real-time room acoustic simulation software.' <http://sourceforge.net/projects/evertims/>, 2008.
- [3] S. Laine and L. Savioja, 'EVERT, acoustic beam-tracing library.' <http://sourceforge.net/projects/evert/>, 2008.
- [4] T. Takala, E. Rousku, T. Lokki, L. Savioja, J. Huopaniemi, R. Väänänen, V. Pulkki, and P. Salminen, 'Marienkirche - a visual and aural demonstration film.' Electronic Art and Animation Catalogue (SIGGRAPH'98), 1998.
- [5] J. Hiipakka, R. Hänninen, T. Ilmonen, H. Napari, T. Lokki, L. Savioja, J. Huopaniemi, M. Karjalainen, T. Tolonen, V. Välimäki, S. Välimäki, and T. Takala, 'Virtual orchestra performance.' Visual Proceedings of SIGGRAPH'97, 1997.
- [6] J. Karjala, H. Kiljander, L. Savioja, and T. Takala, 'Déjà vu.' The Newton group. Video in Int. Symp. on Electronic Arts (ISEA'94) Electronic Theatre, 1994.