

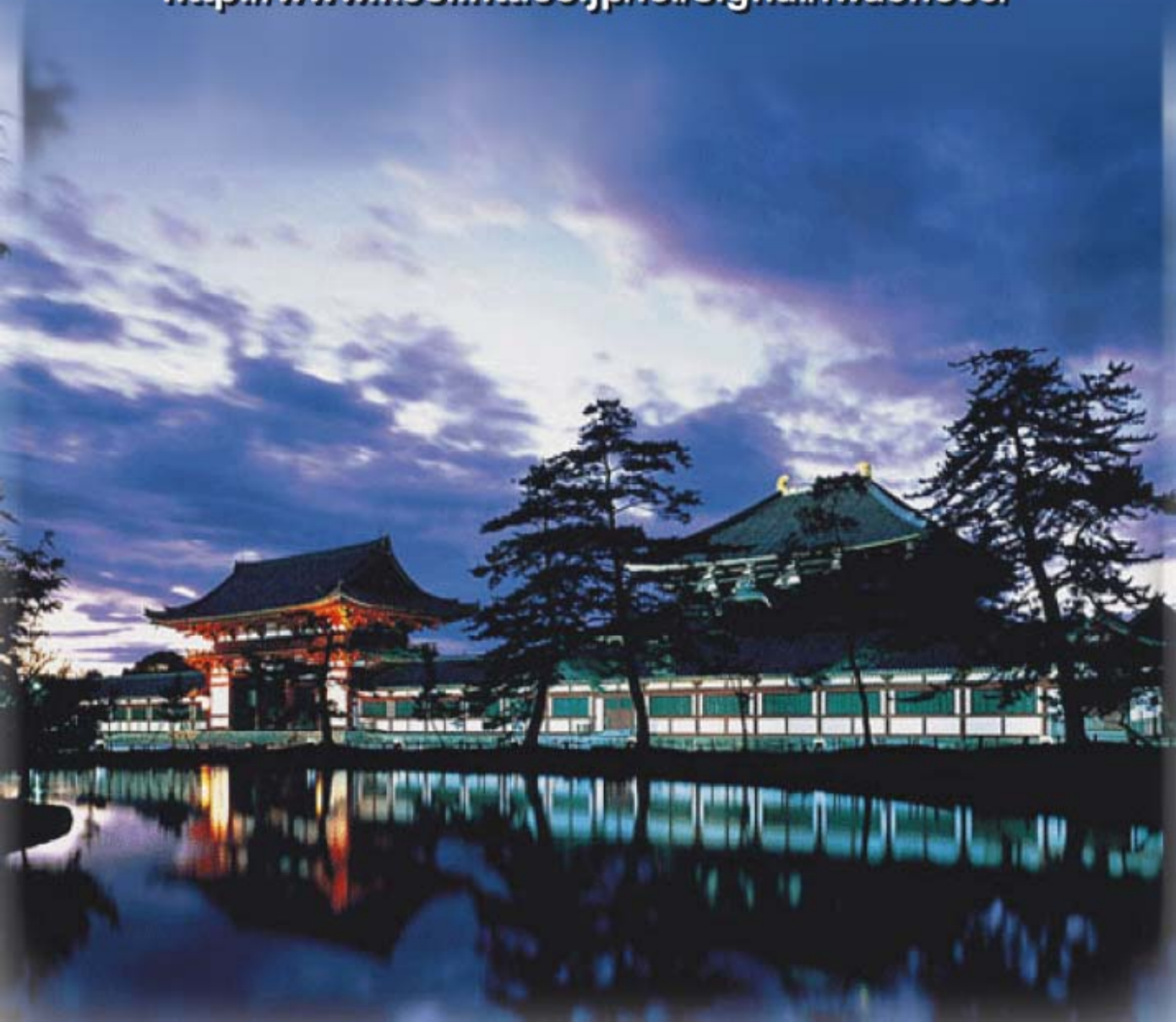
IWAENC 2003
Kyoto

IWAENC 2003

**Eighth International Workshop
on Acoustic Echo and Noise Control**

September 8-11, 2003, Kyoto, Japan

<http://www.kecl.ntt.co.jp/icl/signal/iwaenc03/>



IWAENC 2003

Eighth International Workshop
on Acoustic Echo and Noise Control

September 8-11, 2003, Kyoto, Japan

<http://www.kecl.ntt.co.jp/icl/signal/iwaenc03/>

Proceedings

Edited by

Shoji Makino and Masato Miyoshi

In cooperation with



IEEE Japan Council
IEEE Kansai Section

IEEE Signal Processing Society Japan Chapter



Acoustical Society of Japan



The Institute of
Electronics, Information,
and Communication Engineers

Workshop Committees

Organizing Committee

General Chair:	Shoji Makino	NTT CS Labs	Japan
Program Chairs:	Yoichi Haneda	NTT SP Labs	Japan
	Masato Miyoshi	NTT CS Labs	Japan
Publicity Chair:	Hiroshi Saruwatari	Nara Inst. of Sci. and Tech.	Japan
Publications Chair:	Ryo Mukai	NTT CS Labs	Japan
Communications Chair:	Hiroshi Sawada	NTT CS Labs	Japan
Finance Chair:	Shoko Araki	NTT CS Labs	Japan
Members:	Masato Abe	Iwate Univ.	Japan
	Futoshi Asano	AIST	Japan
	Sadaoki Furui	Tokyo Inst. of Tech.	Japan
	Ken'ichi Furuya	NTT SP Labs	Japan
	Akihiro Hirano	Kanazawa Univ.	Japan
	Osamu Hoshuyama	NEC	Japan
	Yoshinobu Kajikawa	Kansai Univ.	Japan
	Yutaka Kaneda	Tokyo Denki Univ.	Japan
	Nobuhiko Kitawaki	Tsukuba Univ.	Japan
	Satoshi Nakamura	ATR	Japan
	Juro Ohga	Shibaura Inst. of Tech.	Japan
	Hideaki Sakai	Kyoto Univ.	Japan
	Suehiro Shimauchi	NTT SP Labs	Japan
	Masashi Tanaka	NTT-AT	Japan
	Hiroshi Yasukawa	Aichi Prefectural Univ.	Japan
Web Administrators:	Tsuyoki Nishikawa	Nara Inst. of Sci. and Tech.	Japan
	Ryuichi Nisimura	Nara Inst. of Sci. and Tech.	Japan

Technical Committee

Jacob Benesty	Universite du Quebec	Canada
Alberto Carini	Telit Mobile Terminals	Italy
Steven Gay	MIT	USA
Andre Gilloire	CNET	France
Yves Grenier	Telecom Paris	France
Eberhard Haensler	Darmstadt Univ. of Tech.	Germany
Yoichi Haneda	NTT SP Labs	Japan
Walter Kellermann	Univ. of Erlangen	Germany
Shoji Makino	NTT CS Labs	Japan
Rainer Martin	Technical Univ. Braunschweig	Germany
Marc Moonen	Katholieke Universiteit, Leuven	Belgium
Patrick Naylor	Imperial College	UK
Piet Sommen	Eindhoven Univ. of Tech.	Netherlands

IWAENC 2003, September 8–11, 2003

Monday, September 8

16:00–18:00	Registration
18:00–21:00	Reception

Tuesday, September 9

7:00– 9:00	Breakfast
9:00– 9:30	Opening
9:30–11:30	Poster 1: Acoustic Echo Control and Adaptive Filtering Algorithm
11:30–13:30	Lunch
13:30–14:30	Plenary Talk 1: Rainer Martin, Statistical Methods for the Enhancement of Noisy Speech
14:30–16:30	Poster 2: Sound Enhancement and Noise Reduction
16:30–17:30	Plenary Talk 2: Piet Sommen, The Automatic DJ: An appealing and instructive signal processing education project
18:00–21:00	Dinner

Wednesday, September 10

7:00– 9:00	Breakfast
9:30–11:30	Poster 3: Active Noise Control, Hearing Aids, and Hardware
11:30–13:30	Lunch
13:30–18:00	Excursion (Horyuji Temple)
18:00–22:00	Banquet

Thursday, September 11

7:00– 9:00	Breakfast
9:30–11:30	Poster 4: Microphone Array and Sound Separation 1
11:30–13:30	Lunch
13:30–14:30	Plenary Talk 3: Kiyotoshi Matsuoka, Independent Component Analysis and Its Application to Sound Signal Separation
14:30–16:30	Poster 5: Microphone Array and Sound Separation 2
16:30–17:00	Closing Session

Contents

Plenary Talks

[T-1] Statistical Methods for the Enhancement of Noisy Speech	1
<i>Rainer Martin</i>	
[T-2] The Automatic DJ: An Appealing and Instructive Signal Processing Education Project	7
<i>Piet Sommen, Harrie van Meer, Leo Vogten, Jean Ritzerfeld</i>	
[T-3] Independent Component Analysis and its Applications to Sound Signal Separation	15
<i>Kiyotoshi Matsuoka</i>	

Poster 1 Acoustic Echo Control and Adaptive Filtering Algorithm

★[P1-01] An Outlier-Robust Extended Multidelay Filter with Application to Acoustic Echo Cancellation	19
<i>Herbert Buchner, Jacob Benesty, Tomas Gänsler, Walter Kellermann</i>	
★[P1-02] Double-Talk Robust Frequency Domain Echo Cancellation Algorithm with Scalable Nonlinear Reference and Error Functions	23
<i>Suehiro Shimauchi, Yoichi Haneda, Akitoshi Kataoka</i>	
★[P1-03] On the Application of the Unscented Kalman Filter to Speech Processing . .	27
<i>Sharon Gannot, Marc Moonen</i>	
[P1-04] On Data-Reuse Adaptive Algorithms	31
<i>Jacob Benesty, Tomas Gänsler</i>	
[P1-05] An Echo Canceller based on the Structure of Dual-Auxiliary Filters	35
<i>Xiongbing Ou, Zhe Chen, Fuliang Yin</i>	
[P1-06] Acoustic Echo Canceling in the Double-Talk Condition	39
<i>Mohammad Reza Asharif, Rui Chen, Hayato Nakamura, Katsumi Yamashita</i>	
[P1-07] Robust and Elegant, Purely Statistical Adaptation of Acoustic Echo Canceller and Postfilter	43
<i>Gerald Enzner, Peter Vary</i>	
[P1-08] Post-Filtering for Stereo Acoustic Echo Cancellation	47
<i>Markus Kallinger, Jörg Bitzer, Karl-Dirk Kammeyer</i>	
[P1-09] Multichannel Teleconferencing System with Multi Spatial Region Acoustic Echo Cancellation	51
<i>Kong-Aik Lee, Woon-Seng Gan, Jun Yang, Farook Sattar</i>	
[P1-10] Adaptive Parallel Subgradient Projection Techniques with Input Sliding Technique for Stereophonic Acoustic Echo Cancellation	55
<i>Masahiro Yukawa, Isao Yamada</i>	
[P1-11] The Use of Partial Update Schemes to Reduce Inter-Channel Coherence in Adaptive Stereophonic Acoustic Echo Cancellation	59
<i>Andy Wai Hoong Khong, Patrick Naylor</i>	
[P1-12] Stereophonic Acoustic Echo Canceller with Pre-Processing - Second-Order Pre-Processing Filter and its Convergence -	63
<i>Akihiro Hirano, Kenji Nakayama, Kazue Takebe</i>	
[P1-13] Room Impulse Response Variation Due to Thermal Fluctuation and its Impact on Acoustic Echo Cancellation	67
<i>Gary Elko, Eric Diethorn, Tomas Gänsler</i>	
[P1-14] A Method for Detecting Echo Path Variation	71
<i>Jiaquan Huo, Sven Nordholm, Zhuquan Zang</i>	
[P1-15] Proportionate NLMS Algorithm for Second-Order Volterra Filters and its Application to Nonlinear Echo Cancellation	75
<i>Fabian Kuech, Walter Kellermann</i>	
[P1-16] On Performance of Linear Adaptive Filtering Algorithms in Acoustic Echo Control in Presence of Distorting Loudspeakers	79
<i>Riitta Niemistö, Tuomo Mäkelä</i>	

“★” indicate the papers which were highly evaluated by the reviewers.

Poster 2 Sound Enhancement and Noise Reduction

★[P2-01] Noise Reduction by Maximum a Posteriori Spectral Amplitude Estimation with Supergaussian Speech Modeling	83
<i>Thomas Lotter, Peter Vary</i>	
[P2-02] Speech Enhancement in the DFT Domain using Laplacian Speech Priors	87
<i>Rainer Martin, Colin Breithaupt</i>	
[P2-03] Implementation and Effects of Single Channel Dereverberation based on the Harmonic Structure of Speech	91
<i>Tomohiro Nakatani, Masato Miyoshi, Keisuke Kinoshita</i>	
[P2-04] Speech Dereverberation via Subband Implementation of Subspace Methods	95
<i>Sharon Gannot, Marc Moonen</i>	
[P2-05] On the Use of Linear Prediction for Dereverberation of Speech	99
<i>Nikolay Gaubitch, Patrick Naylor, Darren Ward</i>	
[P2-06] Limitations of FIR Multi-Microphone Speech Dereverberation in the Low-Delay Case	103
<i>Markus Hofbauer, Hans-Andrea Loeliger</i>	
[P2-07] Improved Artificial Low-Pass Extension of Telephone Speech	107
<i>Ulrich Kornagel</i>	
[P2-08] Kalman Filter-based Single Microphone Noise Canceller	111
<i>Marcel Gabrea</i>	
[P2-09] Regularized Optimization with Spectral Smoothing for Speech Spectral Estimation	115
<i>Karsten Vandborg Sørensen, Søren Vang Andersen</i>	
[P2-10] Speech Enhancement of Noisy Speech using Log-Spectral Amplitude Estimator and Harmonic Tunneling	119
<i>Hyoun-gook Kim, Markus Schwab, Nicolas Moreau, Thomas Sikora</i>	
[P2-11] Speech Enhancement based on Linear Prediction Error Signals and Spectral Subtraction	123
<i>Agustín Álvarez-Marquina, Víctor Nieto-Lluis, Pedro Gómez-Vilda, Rafael Martínez-Olalla</i>	
[P2-12] Spectral Subtraction based on Speech/noise-Dominant Classification	127
<i>Yukihiro Nomura, Jianming Lu, Hiroo Sekiya, Takashi Yahagi</i>	
[P2-13] Methodology for the Design of a Robust Voice Activity Detector for Speech Enhancement	131
<i>Virginie Gilg, Christophe Beaugeant, Martin Schönle, Bernt Andrassy</i>	
[P2-14] Noise Suppression based on Teager Energy Operator for Improving the Robustness of ASR Front-End	135
<i>Junhui Zhao, Jingming Kuang, Xiang Xie, Huang Shilei</i>	
[P2-15] Effects of Harmonic Components Generated by Polynomial Preprocessor in Acoustic Echo Control	139
<i>Tuomo Mäkelä, Riitta Niemistö</i>	

Poster 3 Active Noise Control, Hearing Aids, and Hardware

★[P3-01] Crosstalk-Resistant Three-Channel Noise Canceller	143
<i>Akihiro Hirano, Kenji Nakayama, Shin'ya Arai</i>	
★[P3-02] Spatially Pre-Processed Speech Distortion Weighted Multi-Channel Wiener Filtering for Noise Reduction in Hearing Aids	147
<i>Ann Spriet, Marc Moonen, Jan Wouters</i>	
[P3-03] Analysis of a Feedback-Type Active Noise Control System with Online Secondary Path Modeling and its Application to Hearing Aids	151
<i>Hideaki Sakai, Shotaro Inoue, Yoichi Hinamoto</i>	
[P3-04] A New Structure for Feedforward Active Noise Control Systems with Online Secondary-Path Modeling	155
<i>Muhammad Tahir Akhtar, Masahide Abe, Masayuki Kawamata</i>	
[P3-05] Multi-Channel Active Noise Control for All Uncertain Primary and Secondary Paths	159
<i>Yuhsuke Ohta, Akira Sano</i>	
[P3-06] Functional Link Artificial Neural Network for Active Control of Nonlinear Noise Processes	163
<i>Ganapati Panda, Debi Prasad Das</i>	
[P3-07] A Theoretical Analysis for Feedforward ANC System with State Equation Model	167
<i>Iwao Nagashiro, Toichi Machida</i>	
[P3-08] Comparison of Adaptive Noise Reduction Algorithms in Dual Microphone Hearing Aids	171
<i>Jean Baptiste Maj, Liesbeth Royackers, Marc Moonen, Jan Wouters</i>	
[P3-09] Active Noise Control using the Perturbation Method -Verification in Actual Multi-Channel Systems-	175
<i>Tasuku Ainoya, Takashi Mori, Yoshinobu Kajikawa, Yasuo Nomura</i>	
[P3-10] An Algorithm for Cancellation of Sidetone Oscillations	179
<i>Martin Schönle, Virginie Gilg</i>	
[P3-11] Real-Time TF-GSC in Nonstationary Noise Environments	183
<i>Israel Cohen, Sharon Gannot, Baruch Berdugo</i>	
[P3-12] Algorithm of a Single Chip Acoustic Echo Canceller using Cascaded Cross Spectral Estimation	187
<i>Marco Liem, Hyoung-Gook Kim, Otto Manck</i>	
[P3-13] Implementing and Evaluating an Audio Teleconferencing Terminal with Noise and Echo Reduction	191
<i>Sumitaka Sakauchi, Akira Nakagawa, Yoichi Haneda, Akitoshi Kataoka</i>	
[P3-14] A PC based Platform for Multichannel Real-Time Audio Processing	195
<i>Hauke Krüeger, Thomas Lotter, Gerald Enzner, Peter Vary</i>	
[P3-15] Perception Oriented, Delay-Controlled Echo Cancellation in IP based Telephone Networks	199
<i>Wolfgang Brandstätter, Frank Kettler</i>	
[P3-16] Improvement of Noise Source Identification by Phase Redundant Acoustical Holography	203
<i>Haruo Uchiyama</i>	

Poster 4 Microphone Array and Sound Separation 1

★[P4-01]	Time Delay Estimation using Spatial Correlation Techniques	207
	<i>Jingdong Chen, Jacob Benesty, Yiteng (Arden) Huang</i>	
★[P4-02]	Blind Source Separation When Speech Signals Outnumber Sensors using a Sparseness-Mixing Matrix Estimation (SMME)	211
	<i>Audrey Blin, Shoko Araki, Shoji Makino</i>	
★[P4-03]	Approaches for Time Difference of Arrival Estimation in a Noisy and Reverberant Environment	215
	<i>Tsvi Gregory Dvorkind, Sharon Gannot</i>	
[P4-04]	Array Geometry Arrangement for Frequency Domain Blind Source Separation	219
	<i>Ryo Mukai, Hiroshi Sawada, Sebastien F. G. M. de la Kethulle de Ryhove, Shoko Araki, Shoji Makino</i>	
[P4-05]	Least-Squares Error Beamforming using Minimum Statistics and Multichannel Frequency-Domain Adaptive Filtering	223
	<i>Robert Aichner, Wolfgang Herboldt, Herbert Buchner, Walter Kellermann</i>	
[P4-06]	DOA Estimation of Speech Signal with a Small Number of Microphone Array in Real Acoustical Environment	227
	<i>Yusuke Hioka, Nozomu Hamada</i>	
[P4-07]	Geometrical Understanding of the PCA Subspace Method for Overdetermined Blind Source Separation	231
	<i>Stefan Winter, Hiroshi Sawada, Shoji Makino</i>	
[P4-08]	Estimation of Direction of Arrival using Matching Pursuit and its Application to Source Separation	235
	<i>Yasuhiro Oikawa, Yoshio Yamasaki</i>	
[P4-09]	A New Adaptive Blocking Matrix with Exact FIR Structure for Robust Generalized Sidelobe Canceller	239
	<i>Zhaorong Hou, Ying Jia</i>	
[P4-10]	Adaptive Beamformer based on Average Vowel / Consonant Spectrum with Phoneme Identification	243
	<i>Masato Nakayama, Takanobu Nishiura, Hideki Kawahara</i>	
[P4-11]	Robust Spatial Estimation of the Signal-to-Interference Ratio for Non-Stationary Mixtures	247
	<i>Wolfgang Herboldt, Tim Trini, Walter Kellermann</i>	
[P4-12]	High-Fidelity Blind Separation of Acoustic Signals using SIMO-Model-based ICA with Information-Geometric Learning	251
	<i>Tomoya Takatani, Tsuyoki Nishikawa, Hiroshi Saruwatari, Kiyohiro Shikano</i>	
[P4-13]	Concurrent Speech Signal Separation based on Frequency Domain Binaural Model	255
	<i>Yoshifumi Chisaki, Takashi Nakanishi, Hidetoshi Nakashima, Tsuyoshi Usagawa</i>	
[P4-14]	Differential Microphone Arrays for Spectral Subtraction	259
	<i>Marc Ihle</i>	
[P4-15]	Sound Source Localization using a Pinna-based Profile Fitting Method	263
	<i>Osamu Ichikawa, Tetsuya Takiguchi, Masafumi Nishimura</i>	

Poster 5 Microphone Array and Sound Separation 2

- ★[P5-01] **Design of Broadband Beamformers Robust Against Microphone Position Errors** 267
Simon Doclo, Marc Moonen
- ★[P5-02] **Blind Separation of More Speech than Sensors with Less Distortion by Combining Sparseness and ICA** 271
Shoko Araki, Shoji Makino, Audrey Blin, Ryo Mukai, Hiroshi Sawada
- ★[P5-03] **Blind Source Separation for Convolutional Mixtures Exploiting Nongaussianity, Nonwhiteness, and Nonstationarity** 275
Herbert Buchner, Robert Aichner, Walter Kellermann
- [P5-04] **Blind Separation for Convolutional Mixture of Many Voices** 279
Kiyotoshi Matsuoka, Yoshihisa Ohba, Yasunobu Toyota, Satoshi Nakashima
- [P5-05] **Identification and Tracking of Active Speaker's Position in Noisy Environments** 283
Tomasz Maciej Rutkowski, Masahiro Yokoo, Danilo P. Mandic
- [P5-06] **Problems in Blind Separation of Convolutional Speech Mixtures by Negentropy Maximization** 287
Raj Kishore Prasad, Hiroshi Saruwatari, Kiyohiro Shikano
- [P5-07] **Introducing New Mechanism in the Learning Process of FDICA-based Speech Separation** 291
Masahiro Furukawa, Yusuke Hioka, Takuro Ema, Nozomu Hamada
- [P5-08] **Speaker Localization Exploiting Spatial-Temporal Information** 295
Tsvi Gregory Dvorkind, Sharon Gannot
- [P5-09] **Evaluation of Blind Separation and Deconvolution for Convolutional Speech Mixture using SIMO-Model-based ICA** 299
Hiroaki Yamajo, Hiroshi Saruwatari, Tomoya Takatani, Tsuyoki Nishikawa, Kiyohiro Shikano
- [P5-10] **Blind Source Separation for Convolutional Mixtures based on Complexity Minimization** 303
Sebastien F. G. M. de la Kethulle de Ryhove, Ryo Mukai, Hiroshi Sawada, Shoji Makino
- [P5-11] **Speech Enhancement Employing Adaptive Beamformer with Recursively Updated Soft Constraints** 307
Hai Q. Dam, Sven Nordholm, Nedelko Grbic, Hai Huyen Dam
- [P5-12] **Spectral Smoothing for Frequency-Domain Blind Source Separation** 311
Hiroshi Sawada, Ryo Mukai, Sebastien F. G. M. de la Kethulle de Ryhove, Shoko Araki, Shoji Makino
- [P5-13] **Considering the Second Peak in the GCC Function for Multi-Source TDOA Estimation with a Microphone Array** 315
Dirk Bechler, Kristian Kroschel
- [P5-14] **Detection of Speech Events in Real Environments Through Fusion of Audio and Video Information using Bayesian Networks** 319
Takashi Yoshimura, Futoshi Asano, Youichi Motomura, Hideki Asoh, Naoyuki Ichimura, Kiyoshi Yamamoto, Satoshi Nakamura

Index

- Abe, M., 155
Aichner, R., **223**, 275
Ainoya, T., **175**
Akhtar, M. T., **155**
Álvarez-Marquina, A., **123**
Andersen, S. V., 115
Andrassy, B., 131
Arai, S., 143
Araki, S., 211, 219, **271**, 311
Asano, F., 319
Asharif, M. R., **39**
Asoh, H., 319
- Beaugeant, C., 131
Bechler, D., **315**
Benesty, J., 19, **31**, 207
Berdugo, B., 183
Bitzer, J., 47
Blin, A., **211**, 271
Brandstätter, W., **199**
Breithaupt, C., 87
Buchner, H., **19**, 223, **275**
- Chen, J., **207**
Chen, R., 39
Chen, Z., 35
Chisaki, Y., **255**
Cohen, I., **183**
- Dam, H. H., 307
Dam, H. Q., **307**
Das, D. P., 163
de la Kethulle de Ryhove, S., 219, **303**,
311
Diethorn, E., 67
Doclo, S., **267**
Dvorkind, T. G., **215**, **295**
- Elko, G., **67**
Ema, T., 291
Enzner, G., **43**, 195
- Furukawa, M., **291**
- Gabrea, M., **111**
Gan, W.-S., 51
Gannot, S., **27**, **95**, 183, 215, 295
Gänsler, T., 19, 31, 67
Gaubitch, N., **99**
Gilg, V., **131**, 179
Gómez-Vilda, P., 123
Grbic, N., 307
- Hamada, N., 227, 291
Haneda, Y., 23, 191
- Herbordt, W., 223, **247**
Hinamoto, Y., 151
Hioka, Y., **227**, 291
Hirano, A., **63**, **143**
Hofbauer, M., **103**
Hou, Z., **239**
Huang, Y., 207
Huo, J., **71**
- Ichikawa, O., **263**
Ichimura, N., 319
Ihle, M., **259**
Inoue, S., 151
- Jia, Y., 239
- Kajikawa, Y., 175
Kallinger, M., **47**
Kammeyer, K.-D., 47
Kataoka, A., 23, 191
Kawahara, H., 243
Kawamata, M., 155
Kellermann, W., 19, 75, 223, 247, 275
Kettler, F., 199
Khong, A. W. H., **59**
Kim, H.-G., **119**, 187
Kinoshita, K., 91
Kornagel, U., **107**
Kroschel, K., 315
Krüeger, H., **195**
Kuang, J., 135
Kuech, F., **75**
- Lee, K.-A., **51**
Liem, M., **187**
Loeliger, H.-A., 103
Lotter, T., **83**, 195
Lu, J., 127
- Machida, T., 167
Maj, J. B., **171**
Mäkelä, T., 79, **139**
Makino, S., 211, 219, 231, 271, 303, 311
Manck, O., 187
Mandic, D. P., 283
Martin, R., **1**, **87**
Martínez-Olalla, R., 123
Matsuoka, K., **15**, **279**
Meer, H., 7
Miyoshi, M., 91
Moonen, M., 27, 95, 147, 171, 267
Moreau, N., 119
Mori, T., 175
Motomura, Y., 319
Mukai, R., **219**, 271, 303, 311

- Nagashiro, I., **167**
Nakagawa, A., 191
Nakamura, H., 39
Nakamura, S., 319
Nakanishi, T., 255
Nakashima, H., 255
Nakashima, S., 279
Nakatani, T., **91**
Nakayama, K., 63, 143
Nakayama, M., **243**
Naylor, P., 59, 99
Niemistö, R., **79**, 139
Nieto-Lluis, V., 123
Nishikawa, T., 251, 299
Nishimura, M., 263
Nishiura, T., 243
Nomura, Y., **127**, 175
Nordholm, S., 71, 307
- Ohba, Y., 279
Ohta, Y., **159**
Oikawa, Y., **235**
Ou, X., **35**
- Panda, G., **163**
Prasad, R. K., **287**
- Ritzerfeld, J., 7
Royackers, L., 171
Rutkowski, T. M., **283**
- Sakai, H., **151**
Sakauchi, S., **191**
Sano, A., 159
Saruwatari, H., 251, 287, 299
Sattar, F., 51
Sawada, H., 219, 231, 271, 303, **311**
Schönle, M., 131, **179**
Schwab, M., 119
Sekiya, H., 127
Shikano, K., 251, 287, 299
Shilei, H., 135
Shimauchi, S., **23**
Sikora, T., 119
Sommen, P., **7**
Sørensen, K. V., **115**
Spriet, A., **147**
- Takatani, T., **251**, 299
Takebe, K., 63
Takiguchi, T., 263
Toyota, Y., 279
Trini, T., 247
- Uchiyama, H., **203**
Usagawa, T., 255
- Vary, P., 43, 83, 195
- Vogten, L., 7
- Ward, D., 99
Winter, S., **231**
Wouters, J., 147, 171
- Xie, X., 135
- Yahagi, T., 127
Yamada, I., 55
Yamajo, H., **299**
Yamamoto, K., 319
Yamasaki, Y., 235
Yamashita, K., 39
Yang, J., 51
Yin, F., 35
Yokoo, M., 283
Yoshimura, T., **319**
Yukawa, M., **55**
- Zang, Z., 71
Zhao, J., **135**

IWAENC 2003 Proceedings

ISBN 4-9901531-3-8

Cover design: Sachiko Tsumori and Keisuke Kinoshita

Cover photo: Nara City Tourism Section and Takehiko Yano

IWAENC 2003

Kyoto, Japan, September, 2003



Acoustic Echo and Noise Control

