

- VELICHKO, V. M., ZAGORUYKO, N. G.: Automatic recognition of 200 words. *Int. J. Man-Machine Studies* **2**, 223-234 (1970).
- VILBIG, F.: An apparatus for speech compression and expansion and for replaying visible speech records. *J. Acoust. Soc. Am.* **22**, 754-761 (1950).
- Frequency band multiplication or division and time expansion or compression by means of a string filter. *J. Acoust. Soc. Am.* **24**, 33-39 (1952).
- HAASE, K.: Some systems for speech-band compression. *J. Acoust. Soc. Am.* **28**, 573-577 (1956a).
- — Über einige Systeme für Sprachbandkompression. *Nachr.-techn. Fachber.* **3**, 81-92 (1956b).
- WAGNER, K. W.: Ein neues elektrisches Sprechgerät zur Nachbildung der menschlichen Vokale. *Preuß. Akad. Wiss. Berlin Abh.* **2**, 44 p. (1936).
- WATHEN-DUNN, W., LIPKE, D. W.: On the power gained by clipping speech in the audio band. *J. Acoust. Soc. Am.* **30**, 36-40 (1958).
- WATSON, T. A.: How bell invented the telephone. *Trans. Am. Inst. Elec. Engrs.* **34**, 1011-1021 (1915).
- WEBER, S.: Modern communication methods. *Electronics* **32**, 94-108 (1959).
- WEBSTER, A. G.: Acoustical impedance and the theory of horns. *Proc. Nat. Acad. Sci. U.S.* **5**, 275-282 (1919).
- WEBSTER, J. C.: Information in simple multidimensional speech messages. *J. Acoust. Soc. Am.* **33**, 940-944 (1961).
- WEGEL, R. L.: Theory of vibration of the larynx. *Bell System Tech. J.* **9**, 207-227 (1930).
- WEINSTEIN, C. J.: Short-time Fourier analysis and its inverse. MS Thesis, Dept. of Electrical Engineering, M.I.T., Cambridge, Mass. (1966).
- OPPENHEIM, A. V.: Predictive coding in a homomorphic vocoder. *IEEE Trans. Aud. Electroacoust.* **AU-19**, 243-248 (1971).
- WERNER, P. A., DANIELSSON, K.: 17 kanals vocoder i laboratorientforande FOA3, Laboratory for National Defense rapport A345, Stockholm 1958.
- WHEATSTONE, Sir CHARLES: The scientific papers of Sir Charles Wheatstone. London: Taylor & Francis 1879.
- WICKELGREN, W. A.: Distinctive features and errors in short term memory for English consonants. *J. Acoust. Soc. Am.* **38**, 388 (1966).
- Distinctive features and errors in short term memory for English vowels. *J. Acoust. Soc. Am.* **38**, 583-588 (1965).
- WIENER, F. M., ROSS, D. A.: The pressure distribution in the auditory canal in a progressive sound field. *J. Acoust. Soc. Am.* **18**, 401-408 (1946).
- WIENER, N.: The extrapolation and smoothing of stationary time series with engineering applications. New York: John Wiley & Sons 1949.
- YAGGI, L. A., Jr.: Full-duplex digital vocoder. Texas Inst. Inc., Dallas, Report SP 14-A62, June 1962.
- MASON, A. E., Jr.: Polymodal vocoder; a new approach to versatile and reliable voice communications. *J. Acoust. Soc. Am.* **35**, 806 (A) (1963).
- YOUNG, M. A., CAMPBELL, R. A.: Effects of context on talker identification. *J. Acoust. Soc. Am.* **42**, 1250-1254 (1967).
- ZWISLOCKI, J.: Theorie der Schneckenmechanik. Diss. Eidg. Tech. Hochschule, Zürich, 1948 (Buchdruckerei Gassman Solothurn).
- Some impedance measurements on normal and pathological ears. *J. Acoust. Soc. Am.* **29**, 1312-1317 (1957).
- Electrical model of the middle ear. *J. Acoust. Soc. Am.* **31**, 841 (A) (1959).

Author Index

Page numbers in *italics* refer to the References

- Abate, J.E. 403, 406
- Ahlfors, L.V. 59, 406
- Alekin 310
- Alekin, R.O., see Chistovich, L.A. 408
- Allen, J. 269, 406
- Alyakrinskii, V.V., see Chistovich, L.A. 310, 408
- Araseki, T., see Kato, Y. 268, 416
- Arnold, J.B., see House, A.S. 298, 299, 300, 415
- Atal, B.S., Hanauer, S.L. 367, 368, 369, 406
- Atal, B.S., Schroeder, M.R. 283, 399, 406
- Atal, B.S., see Schroeder, M.R. 158, 159, 423
- Ayers, E.W. 342, 406
- Balashek, S., see Davis, K.H. 166, 193, 194, 409
- Balashek, S., see Dudley, H. 195, 410
- Barney, H.L., Dunn, H.K. 151, 406
- Barney, H.L., see Dunn, H.K. 410
- Barney, H.L., see Peterson, G.E. 71, 72, 154, 289, 290, 421
- Bastide, R.P., see Stevens, K.N. 228, 425
- Baumann, R.H., Licklider, J.C.R., Howland, B. 199, 406
- Bayston, T.E., Campanella, S.J. 406
- Békésy, G.v. 87, 89, 90, 91, 93, 94, 95, 102, 109, 110, 112, 118, 124, 126, 406
- Békésy, G.v., Rosenblith, W.A. 88, 92, 406
- Belar, H., see Olson, H.F. 199, 420
- Bell, A.G. 2, 3, 206, 207, 210, 406
- Bell, A.M. 206
- Bell, C.G., Fujisaki, H., Heinz, J.M., Stevens, K.N., House, A.S. 172, 173, 174, 406
- Bennett, W.R. 155, 327, 406
- Beraneck, L.L. 311, 316, 406
- Berg, J.W. van den 45, 63, 85, 251, 406
- Berg, J.W. van den, Zantema, J.T., Doornenbal, P., Jr. 45, 46, 210, 406
- Bergeijk, W.A. van 96, 406
- Bially, T., see Gold, B. 413
- Biddulph, R. 155, 157, 338, 406
- Biddulph, R., see Davis, K.H. 166, 193, 194, 409
- Bird, C.M., see Flanagan, J.L. 147, 117, 201, 225, 246, 266, 268, 343, 387, 389, 412
- Björk, L. 407
- Blackett, K., see Purves, B. 422
- Blackman, R.B., Tukey, J.W. 175, 407
- Bliss, J.C. 320, 407
- Bloch, B., Trager, G.L. 15, 407
- Bogert, B.P. 123, 126, 371, 407
- Bogert, B.P., Healy, M.J.R., Tukey, J.W. 176, 185, 407
- Bogert, B.P., Kock, W.E. 407
- Bogert, B.P., see Peterson, L.C. 123, 124, 125, 421
- Bogner, R.E., Flanagan, J.L. 407
- Bolt, R.H., et al. 407
- Bolt, R.H., MacDonald, A.D. 201, 388, 407
- Bondarko, L.U., Zagoruyko, N.G., Kozevnikov, V.A., Molchanov, A.P., Chistovich, L.A. 309, 407
- Bondarko, L.V., Verbitdkaya, L.A., Zinder, L.R., Pavlova, L.P. 407
- Borst, J.M. 213, 407
- Borst, J.M., Cooper, F.S. 212, 407
- Borst, J.M., see Cooper, F.S. 212, 291, 292, 293, 294, 409
- Boyle, A.J.F., see Johnstone, B.M. 93, 109, 117, 416
- Brady, P.T., House, A.S., Stevens, K.N. 284, 407
- Bricker, P.D., Flanagan, J.L. 313, 314, 407
- Broadbent, D.E., see Ladefoged, P. 305, 418
- Brolin, S.J., see Brown, J.M. 407
- Browman, C.P., Coker, C.H., McMahon, L.E., Umeda, N. 407
- Browman, C.P., Coker, C.H., Umeda, N. 407
- Browman, C.P., see Coker, C.H. 83, 192, 269, 270, 409

- Brown, J.M., Brolin, S.J. 407
 Bullington, K., Fraser, J.M. 386, 407
 Bunch, C.C., see Guild, S.R. 137, 414
 Buron, R.H. 407
 Campanella, S.J. 167, 228, 342
 Campanella, S.J., Coulter, D.C., Irons, R. 346, 347, 407
 Campanella, S.J., see Bayston, T.E. 406
 Campbell, R.A., see Young, M.A. 201, 426
 Carlson, A.B. 386, 398, 408
 Carlson, J.P. 408
 Carrol, J.D. 312, 408
 Cassel, L.E., see Steele, R.W. 325, 424
 Chang, S.-H. 166, 167, 228, 342, 408
 Chang, S.-H., Pihl, G., Essigmann, M.W. 167, 408
 Chapman, W.D. 408
 Chase, R., see Stark, R.E. 318, 424
 Cherry, C. 408
 Cherry, L., see Flanagan, J.L. 201, 232, 246, 253, 254, 258, 276, 412
 Chiba, T., Kajiyama, M. 23, 25, 71, 187, 408
 Chistovich, L.A. 306, 309, 310, 408
 Chistovich, L.A., Klaas, A.Yu., Alekin, R.O. 408
 Chistovich, L.A., Kozhevnikov, V.A., Alyakrinskii, V.V. 310, 408
 Chistovich, L.A., see Bondarko, L.U. 309, 407
 Clark, L., see Kiang, N.Y.S. 101, 102, 103, 104, 105, 417
 Cohen, A., 'tHart, J. 297, 408
 Coker, C.H. 82, 83, 174, 191, 192, 273, 343, 408
 Coker, C.H., Cumiskey, P. 175, 268, 408
 Coker, C.H., Umeda, N. 269, 408
 Coker, C.H., Umeda, N., Browman, C.P. 83, 192, 269, 270, 409
 Coker, C.H., see Browman, C.P. 407
 Coker, C.H., see Flanagan, J.L. 147, 192, 201, 225, 246, 266, 268, 343, 412
 Coker, C.H., see Rabiner, L.R. 422
 Colton, F.B. 409
 Cooley, J.W., Tukey, J.W. 175, 409
 Cooper, F.S. 212, 213, 409
 Cooper, F.S., Delattre, P.C., Liberman, A.M., Borst, J.M., Gerstman, L.J. 291, 292, 293, 294, 409
 Cooper, F.S., Gaitenby, J.H., Mattingly, I.G., Umeda, N. 292, 293, 294, 409
 Cooper, F.S., Liberman, A.M., Borst, J.M. 212, 292, 293, 294, 409
 Cooper, F.S., Peterson, E., Fahringer, G.S. 292, 293, 294, 325, 409
 Cooper, F.S., Rand, T.C., Music, R.S., Mattingly, I.G. 292, 293, 294, 409
 Cooper, F.S., see Borst, J.M. 212, 407
 Cooper, F.S., see Liberman, A.M. 293, 294, 302, 303, 308, 418
 Cooper, F.S., see Peterson, E. 331, 421
 Coulter, D.C., see Campanella, S.J. 346, 347, 407
 Crother, W.R., Rader, C.M. 331, 409
 Crowe, S.J., see Guild, S.R. 137, 414
 Cullen, J.K., see Stark, R.E. 318, 424
 Cumiskey, P., see Coker, C.H. 175, 286, 408
 Daguét, J. 372, 409
 Daguét, J., see Marcou, P. 372, 419
 Danielsson, K., see Werner, P.A. 325, 426
 Das, S.K., Mohn, W.S. 201, 409
 David, E.E., Jr. 325, 330, 409
 David, E.E., Jr., McDonald, H.S. 409
 David, E.E., Jr., Schroeder, M.R., Logan, B.F., Prestigiacomo, A.J. 334, 335, 409
 David, E.E., Jr., see Flanagan, J.L. 132, 133, 201, 246, 412
 David, E.E., Jr., see Mathews, M.V. 165, 170, 171, 185, 243, 244, 419
 David, E.E., Jr., see Pierce, J.R. 421
 David, E.E., Jr., see Schroeder, M.R. 334, 423
 Davis, H. 88, 92, 95, 96, 97, 98, 99, 409
 Davis, H., see Stevens, S.S. 278, 425
 Davis, H., see Tasaki, I. 98, 425
 Davis, H., see Teas, D.C. 99, 425
 Davis, K.H., Biddulph, R., Balashek, S. 166, 193, 194, 409
 De Lattre, P., see Liberman, A.M. 293, 294, 302, 308, 418
 Delattre, P.C., see Cooper, F.S. 291, 292, 293, 294, 409
 De Lellis, J., see Freudberg, R. 326, 412
 Denes, P., see Fry, D.B. 196, 197, 412
 Denes, P.B., Mathews, M.V. 198, 409
 Dennis, J.B. 231, 409
 D'Eustachio, D., D'Eustachio, I. 312, 410
 D'Eustachio, I., see D'Eustachio, D. 312, 410
 Dewey, G. 4, 5, 410
 Dickey, E.P., see Forgie, J.W. 412
 Dirks, D., see Moncur, J.P. 312, 420
 Dixon, N.R., Maxey, H.D. 268, 410
 Doddington, G.R. 201, 202, 203, 410
 Dolansky, L.O. 184, 349, 410
 Doornenbal, P., Jr., see Berg, J.W. van den 45, 46, 210, 406
 Dreyfus-Graf, J. 199, 410
 Dudgeon, D.E. 251, 410
 Dudley, H. 184, 211, 323, 324, 332, 410
 Dudley, H., Balashek, S. 195, 410
 Dudley, H., Gruenz, O., Jr. 154, 318, 410
 Dudley, H., Riesz, R.R., Watkins, S.A. 211, 212, 410
 Dudley, H., Tarnóczy, T.H. 205, 410
 Dunn, H.K. 63, 81, 82, 83, 85, 180, 182, 231, 410
 Dunn, H.K., Barney, H.L. 410
 Dunn, H.K., Flanagan, J.L., Gestrin, P.J. 165, 234, 238, 239, 410
 Dunn, H.K., White, S.D. 162, 163, 410
 Dunn, H.K., see Barney, H.L. 151, 406
 Dunn, H.K., see Koenig, W. 150, 417
 Egan, J. 311, 312, 410
 Eldredge, D.H., see Tasaki, I. 98, 425
 Eldredge, D.H., see Teas, D.C. 99, 425
 Elias, P. 391, 410
 Essigmann, M.W., see Chang, S.-H. 167, 408
 Estes, S.E., Kerby, H.R., Maxey, H.D., Walker, R.M. 410
 Everitt, W.L., see Fairbanks, G. 410
 Fahringer, G.S., see Cooper, F.S. 292, 293, 294, 325, 409
 Fairbanks, G. 16, 21, 410
 Fairbanks, G., Everitt, W.L., Jaeger, R.P. 410
 Fano, R.M. 157, 410
 Fant, C.G.M., see Stevens, K.N. 83, 85, 231, 425
 Fant, G. 23, 54, 58, 60, 79, 80, 81, 82, 83, 85, 180, 182, 185, 187, 188, 189, 217, 224, 228, 231, 411
 Fant, G., Stevens, K.N. 411
 Farnsworth, D.W. 12, 13, 411
 Ficks, L., see Pollack, I. 7, 278, 421
 Fischer, F.A. 411
 Flanagan, J.L. 39, 48, 49, 50, 51, 60, 108, 109, 111, 112, 113, 115, 119, 122, 123, 138, 149, 167, 168, 169, 170, 214, 224, 228, 233, 242, 244, 246, 268, 279, 280, 282, 343, 346, 347, 411
 Flanagan, J.L., Bird, C.M. 117, 201, 246, 412
 Flanagan, J.L., Cherry, L. 201, 232, 246, 253, 254, 258, 276, 412
 Flanagan, J.L., Coker, C.H., Bird, C.M. 147, 201, 225, 246, 266, 268, 343, 412
 Flanagan, J.L., Coker, C.H., Rabiner, L.R., Schafer, R.W., Umeda, N. 192, 201, 246, 268, 412
 Flanagan, J.L., David, E.E., Jr., Watson, B.J. 132, 133, 201, 246, 412
 Flanagan, J.L., Golden, R.M. 201, 246, 379, 380, 382, 383, 412
 Flanagan, J.L., Guttman, N. 129, 201, 246, 412
 Flanagan, J.L., Guttman, N., Watson, B.J. 201, 246, 285, 287, 412
 Flanagan, J.L., House, A.S. 170, 201, 246, 342, 412
 Flanagan, J.L., Landgraf, L. 85, 201, 232, 246, 247, 248, 249, 412
 Flanagan, J.L., Öhman 251
 Flanagan, J.L., Saslow, M.G. 201, 246, 281, 412
 Flanagan, J.L., Schroeder, M.R., Bird, C.M. 201, 246, 387, 389, 412
 Flanagan, J.L., Shipley, K. 201, 246, 405, 412
 Flanagan, J.L., et al. 412
 Flanagan, J.L., see Bogner, R.E. 407
 Flanagan, J.L., see Bricker, P.D. 313, 314, 407
 Flanagan, J.L., see Dunn, H.K. 165, 234, 238, 239, 410
 Flanagan, J.L., see Goodman, D.J. 405, 413
 Flanagan, J.L., see Guttman, N. 130, 285, 287, 414
 Flanagan, J.L., see Ishizaka, K. 251, 416
 Flanagan, J.L., see Rabiner, L.R. 268, 270, 271, 272, 422
 Flanagan, J.L., see Schroeder, M.R. 372, 375, 377, 423
 Fletcher, W.W. 14, 412
 Forgie, C.D., see Forgie, J.W. 199, 412
 Forgie, J.W., Forgie, C.D. 199, 412
 Flanagan, J.L., see Teas, D.C. 99, 425
 Essigmann, M.W., see Chang, S.-H. 167, 408
 Estes, S.E., Kerby, H.R., Maxey, H.D., Walker, R.M. 410
 Everitt, W.L., see Fairbanks, G. 410
 Fahringer, G.S., see Cooper, F.S. 292, 293, 294, 325, 409
 Fairbanks, G. 16, 21, 410
 Fairbanks, G., Everitt, W.L., Jaeger, R.P. 410
 Fano, R.M. 157, 410
 Fant, C.G.M., see Stevens, K.N. 83, 85, 231, 425
 Fant, G. 23, 54, 58, 60, 79, 80, 81, 82, 83, 85, 180, 182, 185, 187, 188, 189, 217, 224, 228, 231, 411
 Fant, G., Stevens, K.N. 411
 Farnsworth, D.W. 12, 13, 411
 Ficks, L., see Pollack, I. 7, 278, 421
 Fischer, F.A. 411
 Flanagan, J.L. 39, 48, 49, 50, 51, 60, 108, 109, 111, 112, 113, 115, 119, 122, 123, 138, 149, 167, 168, 169, 170, 214, 224, 228, 233, 242, 244, 246, 268, 279, 280, 282, 343, 346, 347, 411
 Flanagan, J.L., Bird, C.M. 117, 201, 246, 412
 Flanagan, J.L., Cherry, L. 201, 232, 246, 253, 254, 258, 276, 412
 Flanagan, J.L., Coker, C.H., Bird, C.M. 147, 201, 225, 246, 266, 268, 343, 412
 Flanagan, J.L., Coker, C.H., Rabiner, L.R., Schafer, R.W., Umeda, N. 192, 201, 246, 268, 412
 Flanagan, J.L., David, E.E., Jr., Watson, B.J. 132, 133, 201, 246, 412
 Flanagan, J.L., Golden, R.M. 201, 246, 379, 380, 382, 383, 412
 Flanagan, J.L., Guttman, N. 129, 201, 246, 412
 Flanagan, J.L., Guttman, N., Watson, B.J. 201, 246, 285, 287, 412
 Flanagan, J.L., House, A.S. 170, 201, 246, 342, 412
 Flanagan, J.L., Landgraf, L. 85, 201, 232, 246, 247, 248, 249, 412
 Flanagan, J.L., Öhman 251
 Flanagan, J.L., Saslow, M.G. 201, 246, 281, 412
 Flanagan, J.L., Schroeder, M.R., Bird, C.M. 201, 246, 387, 389, 412
 Flanagan, J.L., Shipley, K. 201, 246, 405, 412
 Flanagan, J.L., et al. 412
 Flanagan, J.L., see Bogner, R.E. 407
 Flanagan, J.L., see Bricker, P.D. 313, 314, 407
 Flanagan, J.L., see Dunn, H.K. 165, 234, 238, 239, 410
 Flanagan, J.L., see Goodman, D.J. 405, 413
 Flanagan, J.L., see Guttman, N. 130, 285, 287, 414
 Flanagan, J.L., see Ishizaka, K. 251, 416
 Flanagan, J.L., see Rabiner, L.R. 268, 270, 271, 272, 422
 Flanagan, J.L., see Schroeder, M.R. 372, 375, 377, 423
 Fletcher, W.W. 14, 412
 Forgie, C.D., see Forgie, J.W. 199, 412
 Forgie, J.W., Forgie, C.D. 199, 412

- Forgie, J.W., Forgie, C.D., Dickey, E.P. 412
 Forgie, J.W., Hughes, G.W. 171, 412
 Franke, E.K. 68, 412
 Franklin, G.F., see Ragazzini, J.R. 170, 422
 Fraser, J.M., see Bullington, K. 386, 407
 French, N.R., Steinberg, J.C. 315, 412
 Freudberg, R., De Lellis, J., Howard, C., Schaffer, H. 326, 412
 Frick, F.C. 199, 412
 Fromkin, V.A., see Ladefoged, P. 418
 Fry, D.B., Denes, P. 196, 197, 412
 Fujimura, O. 183, 187, 223, 312, 412
 Fujimura, O., Ishida, H., Kiritani, S. 413
 Fujimura, O., Lindquist, J. 183, 413
 Fujimura, O., see Kiritani, S. 417
 Fujimura, O., see Sawashima, M. 255, 423
 Fujisaki, H., see Bell, C.G. 172, 173, 174, 406
 Fujisaki, H. 173, 268, 399, 413
 Fujisaki, H., Ishida, H. 413
 Fujisaki, H., Kawashima, T. 413
 Fujisaki, H., Yoshimune, K. 413
 Gabor, D. 167, 413
 Gaitenby, J.H., see Cooper, F.S. 292, 293, 294, 409
 Galunov, V.I. 413
 Galambos, R. 128, 413
 Galambos, R., see Rose, J.E. 106, 107, 422
 Galunov 310, 413
 Gannett, D.K., see Miller, R.L. 330
 Gay, T., see Harris, K.S. 414
 Geisler, C.D., see Rhode, W.S. 109, 422
 Gerstman, L., see Liberman, A.M. 293, 294, 302, 308, 418
 Gerstman, L.J., see Cooper, F.S. 291, 292, 293, 294, 409
 Gerstman, L.J., see Kelly, J.L., Jr. 268, 416
 Gestrin, P.J., see Dunn, H.K. 165, 234, 238, 239, 410
 Gill, J.S. 184, 413
 Gold, B. 184, 326, 413
 Gold, B., Bially, T. 413
 Gold, B., Jordan, K.L., Jr. 413
 Gold, B., Lebow, I., McHugh, P., Rader, C. 413
 Gold, B., Rader, C. 265, 326, 413
 Gold, B., Tierney, J. 337, 413
 Gold, B., see Rabiner, L.R. 422
 Golden, R.M. 326, 336, 413
 Golden, R.M., MacLean, D.J., Prestigiacomo, A.J. 336, 413
 Golden, R.M., Kaiser, J.F. 413
 Golden, R.M., see Flanagan, J.L. 201, 246, 379, 380, 382, 383, 412
 Goldstein, M.H., Jr., see Peake, W.T. 421
 Goodman, D.J. 405, 413
 Goodman, D.J., Flanagan, J.L. 405, 413
 Gopinath, B., Sondhi, M.M. 190, 191, 413
 Gopinath, B., see Sondhi, M.M. 424
 Gould, G.T. 378, 413
 Gray, E. 2
 Greefkes, J.A., Jager, F. de 403, 413
 Greefkes, J.A., see Jager, F. de 416
 Greefkes, Tomasawa 404

- Green, H.C., see Potter, R.K. 17, 18, 20, 21, 22, 153, 318, 421
 Griffith, B.C., see Liberman, A.M. 301, 302, 308, 418
 Gruenz, O., Jr., Schott, L.O. 184, 414
 Gruenz, O., Jr., see Dudley, H. 154, 318, 410
 Grützmacher, M., Lottemoser, W. 184, 414
 Guild, S.R., Crowe, S.J., Bunch, C.C., Polvogt, L.M. 137, 414
 Guinan, J.J., Jr., Peake, W.T. 112, 414
 Guttman, N., Flanagan, J.L. 130, 285, 287, 414
 Guttman, N., Nelson, J.R. 321, 414
 Guttman, N., see Flanagan, J.L. 129, 201, 246, 285, 287, 412
 Haase, K., see Vilbig, F. 325, 328, 378, 426
 Haggard, M.P., Mattingly, I.G. 414
 Hall, J.L. 414
 Halle, M. 414
 Halle, M., see Hughes, G.W. 75, 77, 416
 Halsey, R.J., Swaffield, J. 327, 329, 414
 Hammett, J.C., Jr. 363, 414
 Hanauer, S., see Schroeder, M.R. 389, 390, 423
 Hanauer, S.L., Schroeder, M.R. 384, 414
 Hanauer, S.L., see Atal, B.S. 367, 368, 369, 406
 Harlow, A.F. 414
 Harris, C.M. 311, 414
 Harris, K.S., Gay, T. 414
 Harris, K.S., Huntington, D.A., Sholes, G.N. 414
 Harris, K.S., see Liberman, A.M. 301, 302, 303, 308, 418

- Hashimoto, S., see Sugimoto, T. 184, 425
 Haskew, J.R. 391, 398, 414
 Hauser, H., see Oetinger, R. 123, 420
 Hayes, J.R.M., see Licklider, J.C.R. 7, 418
 Healy, M.J.R., see Bogert, B.P. 176, 185, 407
 Hecker, M.H.L. 231, 414
 Heinz, J.M. 25, 54, 179, 181, 209, 245, 251, 414
 Heinz, J.M., Stevens, K.N. 282, 283, 295, 296, 299, 415
 Heinz, J.M., see Bell, C.G. 172, 173, 174, 406
 Heise, G.A., see Miller, G.A. 303, 304, 305, 419
 Helmholtz, H.L.F. v. 207, 211, 212, 415
 Henke, W. 415
 Hildebrand, F.B. 31, 260, 415
 Hiramatsu, K., Kotoh, K. 415
 Hirose, H., see Sawashima, M. 255, 423
 Hixon, T.J., Klatt, D.H., Mead, J. 415
 Hoffman, H.S., see Liberman, A.M. 301, 302, 308, 418
 Holmes, J.N. 185, 186, 245, 415
 Holmes, J.N., Kelly, L.C. 169, 415
 Holmes, J.N., Mattingly, I.G., Shearme, J.N. 268, 415
 Holmes, J.N., see Shearme, J.N. 325, 424
 Houde, R.A. 187, 415
 Houde, R.A., see Slaymaker, F.H. 424
 House, A.S. 415
 House, A.S., Paul, A.P., Stevens, K.N., Arnold, J.B. 415
 House, A.S., Stevens, K.N. 63, 68, 289, 290, 415

- House, A.S., Stevens, K.N., Paul, A.P. 415
 House, A.S., Stevens, K.N., Sandel, T.T., Arnold, J.B. 298, 299, 300, 415
 House, A.S., see Bell, C.G. 172, 173, 174, 406
 House, A.S., see Brady, P.T. 284, 407
 House, A.S., see Flanagan, J.L. 170, 201, 246, 342, 412
 House, A.S., see Stevens, K.N. 82, 83, 180, 289, 425
 Howard, C., see Freudberg, R. 326, 412
 Howard, C.R. 342, 415
 Howell, A.S., Schneider, G.O.K., Stump, T.M. 336, 415, 416
 Howland, B., see Baumann, R.H. 199, 406
 Huggins, W.H. 154, 338, 349, 416
 Hughes, G.W. 171, 172, 416
 Hughes, G.W., Halle, M. 75, 77, 416
 Hughes, G.W., see Forgie, J.W. 171, 412
 Hughes, J.R., see Rose, J.E. 106, 107, 422
 Huntington, D.A., see Harris, K.S. 414
 Ichikawa, A., Nakata, K. 416
 Ingård, U. 28, 416
 Ingemann, F., see Liberman, A.M. 302, 308, 418
 Inoue, S., see Kurematsu, A. 418
 Inomata, S. 184, 416
 Irons, R., see Campanella, S.J. 346, 347, 407
 Ishida, H., see Fujimura, O. 413
 Ishida, H., see Fujisaka, H. 413

- Ishida, H., see Kiritani, S. 417
 Ishizaka, K. 246, 251
 Ishizaka, Flanagan, J.L. 251, 416
 Ishizaka, K., Matsudaira, M. 416
 Itakura, F., Saito, S. 339, 364, 365, 366, 367, 416
 Jackson, L.B., see Rabiner, L.R. 422
 Jaeger, R.P., see Fairbanks, G. 410
 Jager, F. de 348, 404, 416
 Jager, F. de, see Greefkes, J.A. 416
 Jager, F. de, see Greefkes, J.A. 403, 413
 Jayant, N.S. 403, 404, 405, 416
 Jayant, N.S., Rosenberg, A.E. 403, 416
 Johansson 321
 Johnstone, B.M., Boyle, A.J.F. 93, 109, 117, 416
 Jones, E.T., see Stead, L.G. 169, 170, 228, 342, 344, 424
 Jordan, K.L., Jr., see Gold, B. 413
 Judson, L.S., Weaver, A.T. 41, 416
 Kadokawa, Y., Suzuki, J. 416
 Kadokawa, Y., see Suzuki, J. 167, 425
 Kajiyama, M., see Chiba, T. 23, 25, 71, 187, 408
 Kaiser, J.F., see Golden, R.M. 413
 Kaneko, H., see Tomozawa, A. 425
 Karlin, J.E., see Pierce, J.R. 7, 421
 Kasowski, S., see Stevens, K.N. 83, 85, 231, 425
 Kato, H., see Ochiai, Y. 312, 420
 Kato, Y., Ochiai, K., Araseki, T. 268, 416

- Katsuki, Y. 105, 106, 416
 Kautz, W.H. 349, 416
 Kawashima, T., see Fujisaki, H. 413
 Kelly, L.C., see Holmes, J.N. 169, 415
 Kelly, L.C., see Shearme, J.N. 170, 424
 Kelly, J.L., Jr., Gerstman, L.J. 268, 416
 Kelly, J.L., Jr., Lochbaum, C. 85, 232, 273, 276, 417
 Kelly, J.L., Jr., Lochbaum, C., Vyssotsky, V.A. 121, 417
 Kelly, J.M., Miller, R.L. 417
 Kelly, J.M. et al. 399, 400, 401, 417
 Kempelen, W. v. 205, 206, 417
 Kerby, H.R., see Estes, S.E. 410
 Kersta, L.G. 155, 200, 417
 Kharkevich, A.A. 417
 Kiang, N.Y.S., Peake, W.T. 417
 Kiang, N.Y.S., Watenabe, T., Thomas, E., Clark, L. 101, 102, 103, 104, 105, 417
 Kiang, N.Y.S., see Peake, W.T. 421
 Kiritani, S., Fujimura, O., Ishida, H. 417
 Kiritani, S., see Fujimura, O. 413
 Kiritani, S., see Sawashima, M. 255, 423
 Klaas 310
 Klaas, A.Yu., see Chistovich, L.A. 408
 Klatt, D.H., see Hixon, T.J. 415
 Klein, D.B., see Manley, H.J. 350, 351, 419
 Kock, W.E. 338, 417
 Kock, W.E., Miller, R.L. 154, 417
 Kock, W.E., see Bogert, B.P. 407
 Koenig, R. 207, 211, 417
 Koenig, W., Dunn, H.K., Lacey, L.Y. 150, 417
 Kopp, G.A., see Potter, R.K. 17, 18, 20, 21, 22, 153, 318, 421
 Kotoh, K., see Hiramatsu, K. 415
 Kozevnikov, V.A., see Bondarko, L.U. 309, 407
 Kozhevnikov, V.A., see Chistovich, L.A. 310, 408
 Kraft, L.G. 157, 417
 Kramer, H.P., Mathews, M.V. 331, 417
 Kratzenstein, C.G. 205, 417
 Kringelbotn, M. 320, 417
 Kropfl, W. 417
 Kruskal, J. 312, 417
 Kryter, K.D. 316, 317, 417
 Kubo, E., see Oizumi, J. 211, 420
 Kulya, V.I. 355, 359, 360, 417
 Kurematsu, A., Inoue, S. 418
 Lacey, L.Y., see Koenig, W. 150, 417
 Ladefoged, P. 307, 308, 418
 Ladefoged, P., Broadbent, D.E. 305, 418
 Ladefoged, P., Fromkin, V.A. 418
 Landgraf, L., see Flanagan, J.L. 85, 201, 232, 246, 247, 248, 249, 412
 Laplace 73, 109
 Lashbrook, B., see Tosi, O. 425
 Lawrence, W. 228, 344, 418
 Lebow, I., see Gold, B. 413
 Lee, F.F. 155, 268, 269, 355, 357, 418
 Lee, Y.W. 418

- Lehiste, I., see Peterson, G.E. 17, 421
 Levitt, H., Nelson, J.R. 321, 418
 Liberman, A.M., Cooper, F.S., Harris, K.S., MacNeilage, P.F. 302, 303, 308, 418
 Liberman, A.M., De Lattre, P.C., Cooper, F.S., Gerstman, L. 293, 294, 302, 308, 418
 Liberman, A.M., Harris, K.S., Hoffman, H.S., Griffith, B.C. 301, 302, 308, 418
 Liberman, A.M., Ingemann, F., Lisker, L., De Lattre, P., Cooper, F.S. 302, 308, 418
 Liberman, A.M., see Cooper, F.S. 212, 291, 292, 293, 294, 409
 Lichten, W., see Miller, G.A. 303, 304, 305, 419
 Licklider, J.C.R. 418
 Licklider, J.C.R., Pollack, I. 418
 Licklider, J.C.R., Stevens, K.N., Hayes, J.R.M. 7, 418
 Licklider, J.C.R., see Baumman, R.H. 199, 406
 Lieberman, P. 285, 418
 Lindblom, B. 418
 Lindgren, N. 199, 418
 Lindquist, J., see Fujimura, O. 183, 413
 Linvill, J. 320, 418
 Lipke, D.W., see Wathen-Dunn, W. 426
 Lisker, L., see Liberman, A.M. 302, 308, 418
 Lochbaum, C., see Kelly, J.L., Jr. 85, 121, 232, 273, 276, 417
 Logan, B.F., see David, E.E., Jr. 334, 335, 409
 Logan, B.F., see Schroeder, M.R. 377, 378, 423
 Lottemoser, W., see Grütz-macher, M. 184, 414

- Lumms, R.C. 201, 202, 418
 Lundry, E.A., see Schroeder, M.R. 372, 375, 377, 423
 MacDonald, A.D., see Bolt, R.H. 201, 388, 407
 Mackie, G.B., see Sass, E.J. 376, 423
 MacLean, D.J., see Golden, R.M. 336, 413
 MacNeilage, P.F., see Liberman, A.M. 302, 303, 308, 418
 Malécot, A. 291, 418
 Malme, C.I. 282, 283, 418
 Manley, H.J., Klein, D.B. 350, 351, 419
 Manley, J.J. 355, 358, 359, 419
 Marcou, P., Daguet, J. 372, 419
 Markel, J.D. 369, 370, 419
 Martin, T.B., Nelson, A.L., Zadell, A.J. 199, 419
 Mason, A.E., Jr., see Yaggi, L.A., Jr. 325, 329, 336, 426
 Mathews, M.V. 419
 Mathews, M.V., Miller, J.E., David, E.E., Jr. 165, 170, 171, 185, 243, 244, 419
 Mathews, M.V., Walker, P. 85, 419
 Mathews, M.V., see Denes, P.B. 198, 409
 Mathews, M.V., see Kramer, H.P. 331, 417
 Matsudaira, M., see Ishizaka, K. 416
 Matsui, E. 419
 Mattingly, I.G. 419
 Mattingly, I.G., see Cooper, F.S. 292, 293, 294, 409
 Mattingly, I.G., see Haggard, M.P. 414
 Mattingly, I.G., see Holmes, J.N. 268, 415
 Maxey, H.D., see Dixon, N.R. 268, 410

- Maxey, H.D., see Estes, S.E. 410
 McDermott, B., see Nakatani, L.H. 420
 McDonald, H.S., see David, E.E., Jr. 409
 McDonald, R.A. 395, 396, 397, 398, 419
 McGonegal, C.A., see Rabiner, L.R. 422
 McHugh, P., see Gold, B. 413
 McMahan, L.E., see Browman, C.P. 407
 Mead, J., see Hixon, T.J. 415
 Meeker, W.F., Nelson, A.L., Scott, P.B. 419
 Mermelstein, P. 85, 190, 276, 419
 Meyer-Eppler, W. 55, 58, 154, 210, 419
 Meyer-Eppler, W., Ungeheuer, G. 419
 Miller, D.C. 207, 211, 419
 Miller, G.A. 281, 305, 310, 419
 Miller, G.A., Heise, G.A., Lichten, W. 303, 304, 305, 419
 Miller, J.E., see Mathews, M.V. 165, 170, 171, 185, 243, 244, 419
 Miller, R.L. 185, 186, 325, 420
 Miller, R.L., Gannett, D.K. 330
 Miller, R.L., see Kelly, J.M. 417
 Miller, R.L., see Kock, W.E. 154, 417
 Mohn, W.S., see Das, S.K. 201, 409
 Molchanov, A.P., see Bondarko, L.U. 309, 407
 Møller, A.R. 90, 91, 112, 113, 420
 Moncur, J.P., Dirks, D. 312, 420
 Montgomery, H.C., see Munson, W.A. 166, 340, 341, 420

- Morse, P.M. 25, 36, 39, 67, 420
 Munson, W.A., Montgomery, H.C. 166, 340, 341, 420
 Music, R.S., see Cooper, F.S. 292, 293, 294, 409
 Nakata, K. 268, 297, 420
 Nakata, K., Suzuki, J. 289, 420
 Nakata, K., see Ichikawa, A. 416
 Nakata, K., see Suzuki, J. 167, 425
 Nakatani, L.H. 312, 420
 Nakatani, L.H., McDermott, B. 420
 Nelson, A.L., see Martin, T.B. 199, 419
 Nelson, A.L., see Meeker, W.F. 419
 Nelson, J.R., see Guttman, N. 321, 414
 Nelson, J.R., see Levitt, H. 321, 418
 Netter, F. 100, 420
 Nevel'skii, P.B. 310, 420
 Nicol, J., see Tosi, O. 425
 Noll, A.M. 184, 185, 420
 Nyquist 376
 Ochiai, K., see Kato, Y. 268, 416
 Ochiai, Y. 312, 420
 Ochiai, Y., Kato, H. 312, 420
 Öhman, see Flanagan, J.L. 251
 Öhman, S.E.G. 420
 Oetinger, R., Hauser, H. 123, 420
 Oizumi, J., Kubo, E. 211, 420
 Olive, J.P. 173, 420
 Olson, H.F. 420
 Olson, H.F., Belar, H. 199, 420
 O'Neal, J.B., Jr. 420
 O'Neil, E.F. 386, 420
 Oppenheim, A.V. 361, 362, 420

- Oppenheim, A. V., Schafer, R. W. 361, 420
 Oppenheim, A. V., Schafer, R. W., Stockham, T. G. 184, 362, 421
 Oppenheim, A. V. et al. 421
 Oppenheim, A. V., see Weinstein, C. J. 363, 426
 Oyer, H., see Tosi, O. 425
- Paget, Sir Richard 9, 207, 421
 Papoulis, A. 421
 Paul, A. P., see House, A. S. 415
 Pavlova, L. P., see Bondarko, L. V. 407
 Peake, W. T., Goldstein, M. H., Jr., Kiang, N. Y.-S. 421
 Peake, W. T., Kiang, N. Y.-S., Goldstein, M. H., Jr. 421
 Peake, W. T., see Guinan, J. J., Jr. 112, 414
 Peake, W. T., see Kiang, N. Y.-S. 417
 Pedrey, C., see Tosi, O. 425
 Perrell, J. S. 187, 421
 Peterson, E. 166, 421
 Peterson, E., Cooper, F. S. 331, 421
 Peterson, E., see Cooper, F. S. 292, 293, 294, 325, 409
 Peterson, G. E., Barney, H. L. 71, 72, 154, 289, 290, 421
 Peterson, G. E., Lehiste, I. 17, 421
 Peterson, G. E., Wang, W. S.-Y., Siverston, E. 421
 Peterson, G. E., see Subrahmanyam, D. L. 425
 Peterson, L. C., Bogert, B. P. 123, 124, 125, 421
 Pickett, J. M. 318, 319, 320, 421
 Pierce, J. R. 199, 421
 Pierce, J. R., David, E. E., Jr. 421
- Pierce, J. R., Karlin, J. E. 7, 421
 Pihl, G., see Chang, S.-H. 167, 408
 Pimonow, L. 321, 421
 Pirogov, A. A. 352, 353, 421
 Pollack, I. 278, 421
 Pollack, I., Ficks, L. 7, 278, 421
 Pollack, I., see Licklider, J. C. R. 418
 Polvogt, L. M., see Guild, S. R. 137, 414
 Potter, R. K., Kopp, G. A., Green, H. C. 17, 18, 20, 21, 22, 153, 318, 421
 Potter, R. K., Steinberg, J. C. 167, 421
 Prestigiaco, A. J. 152, 155, 421
 Prestigiaco, A. J., see David, E. E., Jr. 334, 335, 409
 Prestigiaco, A. J., see Golden, R. M. 336, 413
 Prestigiaco, A. J., see Schroeder, M. R. 377, 378, 423
 Pruzansky, S. 200, 421
 Purves, B., Blackett, K., Strong, W. 422
- Rabiner, L. R. 268, 422
 Rabiner, L. R., Gold, B., McGonegal, C. A. 422
 Rabiner, L. R., Jackson, L. B., Schafer, R. W., Coker, C. H. 422
 Rabiner, L. R., Schafer, R. W., Flanagan, J. L. 268, 270, 271, 272, 422
 Rabiner, L. R., Schafer, R. W., Rader, C. M. 175, 178, 422
 Rabiner, L. R., see Flanagan, J. L. 192, 201, 246, 268, 412
 Rabiner, L. R., see Rosenberg, A. E. 345, 423
 Rabiner, L. R., see Schafer, R. W. 175, 179, 185, 423
- Rader, C., see Gold, B. 265, 326, 413
 Rader, C. M., see Crowther, W. R. 331, 409
 Rader, C. M., see Rabiner, L. R. 175, 178, 422
 Ragazzini, J. R., Franklin, G. F. 170, 422
 Rand, T. C., see Cooper, F. S. 292, 293, 294, 409
 Ranke, O. F. 123, 422
 Reddy, D. R. 198, 422
 Reis, P. 2
 Reissner 92, 93
 Rhode, W. S. 93, 117, 422
 Rhode, W., Geisler, C. D. 109, 422
 Rhodes, F. L. 422
 Richardson, E. G. 311, 422
 Riesz, R. R. 207, 208, 278, 422
 Riesz, R. R., Schott, L. 154, 318, 422
 Riesz, R. R., see Dudley, H. 211, 212, 410
 Risberg, A. 318, 422
 Ritsma, R. 130, 422
 Rose, J. E., Galambos, R., Hughes, J. R. 106, 107, 422
 Rosen, G. 83, 85, 231, 422
 Rosenberg, A. E. 130, 186, 202, 244, 245, 282, 423
 Rosenberg, A., Schafer, R. W., Rabiner, L. R. 345, 422
 Rosenberg, A. E., see Jayant, N. S. 403, 416
 Rosenblith, W. A., Stevens, K. N. 278, 423
 Rosenblith, W. A., see Békésy, G. v. 88, 92, 406
 Ross, D. A., see Wiener, F. M. 88, 426
 Ruiz, P. M. 423
 Russel, G. O. 423
- Saito, S., see Itakura, F. 339, 364, 365, 366, 367, 416
 Sandel, T. T., see House, A. S. 298, 299, 300, 415

- Sapozhkov, M. A. 423
 Saslow, M. G., see Flanagan, J. L. 201, 246, 281, 412
 Sass, E. J., Mackie, G. B. 376, 423
 Sawashima, M. 255, 423
 Sawashima, M., Hirose, H., Kiritani, S., Fujimura, O. 255, 423
 Schafer, R. W., Rabiner, L. R. 175, 179, 185, 423
 Schafer, R. W., see Flanagan, J. L. 192, 201, 246, 268, 412
 Schafer, R. W., see Oppenheim, A. V. 184, 361, 362, 420, 421
 Schafer, R. W., see Rabiner, L. R. 175, 178, 268, 270, 271, 272, 422
 Schafer, R. W., see Rosenberg, A. E. 345, 423
 Schaffer, H., see Freudberg, R. 326, 412
 Schneider, G. O. K., see Howell, A. S. 336, 415, 416
 Schott, L., see Riesz, R. R. 154, 318, 422
 Schott, L. O. 212, 423
 Schott, L. O., see Gruenz, O., Jr. 184, 414
 Schroeder, M. R. 167, 190, 338, 339, 423, 424
 Schroeder, M. R., Atal, B. S. 158, 159, 423
 Schroeder, M. R., David, E. E., Jr. 334, 423
 Schroeder, M. R., Hanauer, S. 389, 390, 423
 Schroeder, M. R., Logan, B. F., Prestigiaco, A. J. 377, 378, 423
 Schroeder, M. R., Flanagan, J. L., Lundry, E. A. 372, 375, 377, 424
 Schroeder, M. R., see Atal, B. S. 283, 399, 400, 406
 Schroeder, M. R., see David, E. E., Jr. 334, 335, 409

- Schroeder, M. R., see Flanagan, J. L. 201, 246, 387, 389, 412
 Schroeder, M. R., see Hanauer, S. L. 384, 414
 Scott, P. B., see Meeker, W. F. 419
 Seki, H. 372, 424
 Shannon, C. E. 4, 424
 Shannon, C. E., Weaver, W. 4, 424
 Shearme, J. N. 169, 424
 Shearme, J. N., Holmes, J. N. 325, 424
 Shearme, J. N., Smith, G. F., Kelly, L. C. 170, 424
 Shearme, J. N., see Holmes, J. N. 268, 415
 Shepard, R. 312, 424
 Shipley, K., see Flanagan, J. L. 201, 246, 405, 412
 Sholes, G. N., see Harris, K. S. 414
 Simon, Pela 424
 Siverston, E., see Peterson, G. E. 421
 Sivian, L. J. 162, 424
 Slaymaker, F. H. 325, 424
 Slaymaker, F. H., Houde, R. A. 424
 Smith, C. P. 199, 424
 Smith, C. P., see Stevens, K. N. 228, 425
 Smith, G. F., see Shearme, J. N. 170, 424
 Smith, S. 243, 332, 333, 424
 Sondhi, M. M. 424
 Sondhi, M. M., Gopinath, B. 424
 Sondhi, M. M., see Gopinath, B. 190, 191, 413
 Stark, R. E., Cullen, J. K., Chase, R. 318, 424
 Stead, L. G., Jones, E. T. 169, 170, 228, 342, 344, 424
 Stead, L. G., Weston, R. C. 344, 345, 424
 Steele, R. W., Cassel, L. E. 325, 424
 Steinberg, J. C., see French, N. R. 315, 412

- Steinberg, J. C., see Potter, R. K. 167, 421
 Stevens, K. N. 58, 157, 280, 425
 Stevens, K. N., Bastide, R. P., Smith, C. P. 228, 425
 Stevens, K. N., House, A. S. 82, 83, 180, 289, 425
 Stevens, K. N., Kasowski, S., Fant, C. G. M. 83, 85, 231, 425
 Stevens, K. N., see Bell, C. G. 172, 173, 174, 406
 Stevens, K. N., see Brady, P. T. 284, 407
 Stevens, K. N., see Fant, G. 411
 Stevens, K. N., see Heinz, J. M. 282, 283, 295, 296, 299, 414
 Stevens, K. N., see House, A. S. 63, 68, 289, 290, 298, 299, 300, 415
 Stevens, K. N., see Licklider, J. C. R. 7, 418
 Stevens, K. N., see Rosenblith, W. A. 278, 423
 Stevens, S. S., Davis, H. 278, 425
 Stewart, J. Q. 211, 425
 Stockham, T. G., see Oppenheim, A. V. 184, 362, 421
 Strong 85
 Strong, W., see Purves, B. 422
 Stump, T. M., see Howell, A. S. 336, 415, 416
 Stumpf, C. 207, 211, 425
 Subrahmanyam, D. L., Peterson, G. E. 425
 Sugimoto, T., Hashimoto, S. 184, 425
 Suzuki, J., Kadokawa, Y., Nakata, K. 167, 425
 Suzuki, J., Nakata, K. 425
 Suzuki, J., see Kadokawa, Y. 416
 Suzuki, J., see Nakata, K. 289, 420
 Swaffield, J., see Halsey, R. J. 327, 329, 414

- Tarnóczy, T.H., see
Dudley, H. 205, 410
- Tasaki, I., Davis, H.,
Eldredge, D.H. 98, 425
- Teas, D.C., Eldredge, D.H.,
Davis, H. 99, 425
- Teranishi, R., Umeda, N.
269, 425
- 'tHart, J., see Cohen, A.
297, 408
- Thomas, E., see Kiang,
N.Y.S. 101, 102, 103,
104, 105, 417
- Tierney, J., see Gold, B. 413
- Titchmarsh, E.C. 59, 215,
425
- Tomasawa, see Greefkes 404
- Tomozawa, A., Kaneko, H.
425
- Tosi, O. 201, 425
- Tosi, O., Oyer, H., Pedrey,
C., Lashbrook, B., Nicol,
J. 425
- Trager, G.L., see Bloch, B.
15, 407
- Truby, H.M. 425
- Tschebyscheff 360
- Tukey, J.W., see Blackman,
R.B. 175, 407
- Tukey, J.W., see Bogert,
B.P. 176, 185, 407
- Tukey, J.W., see Cooley,
J.W. 175, 409
- Tunturi, A.R. 101, 106,
425
- Umeda, N., see Browman,
C.P. 407
- Umeda, N., see Coker,
C.H. 83, 192, 269, 270,
408, 409
- Umeda, N., see Cooper,
F.S. 292, 293, 294, 409
- Umeda, N., see Flanagan,
J.L. 192, 201, 246, 268,
412
- Umeda, N., see Teranishi,
R. 269, 425
- Ungeheuer, G. 23, 25, 425
- Ungeheuer, G., see Meyer-
Eppler, W. 419
- Upton, H. 319, 425
- Velichko, V.M., Zagoruyko,
N.G. 199, 426
- Verbitdkaya, L.A., see
Bondarko, L.V. 407
- Vilbig, F. 378, 426
- Vilbig, F., Haase, K. 325,
328, 378, 426
- Vyssotsky, V.A., see Kelly,
J.L., Jr. 121, 417
- Wagner, K.W. 426
- Walker, P., see Mathews,
M.V. 85, 419
- Walker, R.M., see Estes,
S.E. 410
- Wang, W.S.-Y., see
Peterson, G.E. 421
- Watanabe, T., see Kiang,
N.Y.S. 101, 102, 103,
104, 105, 417
- Wathen-Dunn, W., Lipke,
D.W. 426
- Watkins, S.A., see
Dudley, H. 211, 212, 410
- Watson, B.J., see Flanagan,
J.L. 132, 133, 201, 246,
285, 287, 412
- Watson, T.A. 3, 210, 426
- Weaver, A.T., see Judson,
L.S. 41, 416
- Weaver, W., see Shannon,
C.E. 4, 424
- Weber, S. 426
- Webster, A.G. 25, 190,
272, 426
- Webster, J.C. 7, 25, 426
- Wegel, R.L. 45, 210, 426
- Weinstein, C.J. 144, 426
- Weinstein, C.J., Oppenheim,
A.V. 363, 426
- Werner, P.A., Danielsson,
K. 325, 426
- Weston, R.C., see Stead,
L.G. 344, 345, 424
- Wheatstone, Sir Charles
205, 206, 426
- White, S.D., see Dunn,
H.K. 162, 163, 410
- Wickelgren, W.A. 310, 426
- Wiener, F.M., Ross, D.A.
88, 426
- Wiener, N. 155, 426
- Yaggi, L.A., Jr. 325, 336,
426
- Yaggi, L.A., Jr., Mason,
A.E., Jr. 325, 329, 336,
426
- Yoshimune, K., see
Fujisaki, H. 413
- Young, M.A., Campbell,
R.A. 201, 426
- Zadell, A.J., see Martin,
T.B. 199, 419
- Zagoruyko, N.G., see
Bondarko, L.U. 309, 407
- Zagoruyko, N.G., see
Velichko, V.M. 199, 426
- Zantema, J.T., see Berg,
J.W. van den 45, 46,
210, 406
- Zinder, L.R., see Bondarko,
L.V. 407
- Zwislocki, J. 90, 91, 112,
113, 123, 426

Subject Index

- absolute discrimination 278
- of speech and speech-like sounds
288
- identification of phonemes 288
- of syllables 291
- acoustic capacitance 30–31
- compliance 30–31
- conductance 31–34
- impedance 36
- inertance 28
- resistance 28
- tube 229
- —, non uniform 229
- volume velocity 28
- adaptive delta modulation (ADM) 403
- — —, digitalization of 400
- adaptive predictive coding 399
- adiabatic constant 30, 35
- law 30, 32
- affricates 22
- air compliance 30
- mass 28
- allophone 15
- all-pole model of the speech spectrum
364, 368
- amplitude spectrum, short-time 228
- analogous acoustic elements 34
- analysis-by-synthesis 172
- -synthesis telephony 8, 321, 322,
323
- — systems 9
- analytic rooter 372
- area functions 276
- Articulation Index 278, 315
- relation to intelligibility score 317
- articulation scores 8
- tests 277, 310
- articulatory analysis 179, 187
- configuration 17–21
- training of deaf children 318
- vocoders 370
- artificial speech 205
- auditory cortex 101
- dimensions (in perception) 308
- memory 310
- nerve 86, 93
- psychophysics 277
- tract, electrophysiology of 204
- autocorrelation function, short time
337
- vocoder 338
- arytenoid cartilages 11
- attenuation constant 27, 67
- Audrey 193
- average information 3
- axis crossings, relation to formant
frequencies 165
- band-pass filters 211
- bandwidth compression, systems for
232
- basilar membrane 92, 93
- —, computational model 109
- — displacement, simulation by
electric circuit 117
- — motion, computer simulation
119
- —, temporal resolution of 149
- behavior, subjective and physiological
126
- Bernoulli effect 12
- binaural information, processing of 132
- lateralization 130
- bit rates for delta modulation 405
- — for PCM 405
- boundary layer 29, 32
- —, thermal 32
- —, viscous 29
- bronchi 42
- capacitance 26, 30–31
- , acoustic 30–31
- , —, per-unit-length 31
- cartilage, arytenoid 11
- , cricoid 11
- , thyroid 11
- cascade synthesizers 223
- cavities, acoustically coupled 77, 82

cavity-mode affiliation 82
 — wall vibration 65–69
 cepstrum analysis 361
 — of speech 175, 184
 channel capacity 4, 86
 — — of the human 6
 — — of speech 4
 — vocoders 210, 323
 — —, digital design of 325, 328
 — —, multiplexing of 326
 — —, performance of 329
 — —, reduced redundancy 330
 characteristic frequency 102
 — impedance 229
 — period 105
 chest cavity 11
 Chirp Z-transform 175, 177
 clicks, binaural lateralization of 131
 cochlea 91
 —, cross section of 92
 cochlear microphonic 97, 98, 99
 — nerve 101
 — nucleus 96, 101, 106
 — potentials 97
 coefficient of heat conduction 31, 34
 — viscosity 34, 45, 55
 cognates 19
 comb filtering 283
 compensation articulation 16, 72
 complex residue 228
 — signals, auditory processing of 139
 compliance, acoustic 30–31
 compressibility (of air) 31
 computational model for ear function 108
 — — for ear function, frequency response 116
 — — for ear function, impulse response 115
 computer simulation 77, 85
 — — of basilar-membrane motion, impulse response 121
 concatenation, synthesis by 271
 conductance, acoustic 31–34
 — —, per-unit-length 34, 66
 confusion matrices 290
 consonants 4, 18, 294
 —, affricate 22
 —, fricative 18, 19, 54, 55, 72–77
 —, nasal 21, 77–79
 —, perception of 294, 296
 —, stop 19, 54, 56–58

continuants 14, 18
 continuous channel 4
 cophasic and antiphase clicks, binaural lateralization of 134
 correlation function, short-time 155
 — vocoders 337
 correlatograph 155
 cricoid cartilage 11, 12

delta modulation (DM) 401
 density of air 28, 34, 55
 difference equations 260, 273
 — limens 279
 — — for formant amplitude 280
 — — for formant bandwidth 281
 — — for formant frequency 279
 — — for fundamental frequency 281
 — — for glottal zeros 281
 — — for intensity 281, 283
 differential discrimination 277
 — — in the articulatory domain 286
 — — for fundamental frequency 281
 — — for intensity 281
 — pulse code modulation (DPCM) 395
 diffraction (about the head) 38
 diffusion equation 29, 31
 digital computer, simulation by 77, 85
 — —, — of the vocal tract 85
 — resonators 265
 digram frequencies 4
 diphthongs 4, 22
 disguised voices 201
 driving-point impedance of the mouth 219

eardrum 88
 efficient communication 321
 eigenfrequencies of non-uniform tract 273
 electrical analog (of the vocal tract) 35, 83–85
 endolymph 92
 English speech sounds, relative frequencies 5
 envelope 146
 equivalent circuit for glottal source 46, 50–51
 — — for lossy pipe 25–35
 — — — —, modified 66
 — — for subglottal system 42

error samples, correlation of 397
 excitation, forward-source 72–77
 —, glottal 41–43
 — intensity, limens for 281
 —, noise 14, 15, 53–58, 72–77
 — of the vocal tract 12, 23
 —, transient 15, 53–58
 —, unvoiced 14, 15
 —, voiced 12, 41
 exponential functions 349
 external ear canal 88

Fast Fourier Transform 362
 feature analysis of speech 198
 feedback around the quantizer 395
 —, auditory 9
 — in speech production 308
 —, kinesthetic 9
 fidelity criteria (for speech transmission) 6, 86
 firing rate, neural 105
 F1-vs-F2 plot 72
 formant amplitude, limens for 280
 — analysis 162
 — bandwidth 60, 63, 64, 69, 164, 181, 224, 281
 — -coded words, concatenation of 271
 — damping 60, 63, 64
 — extraction by digital computer 170
 — frequency 59, 63, 64, 69, 70–72, 82, 154
 — —, limens for 279
 — functions, interpolation of 270
 — synthesis 260
 — tracking by maximum-likelihood method 366
 — — by linear prediction method 369
 — transitions between consonants and vowels 293
 — tuning 224
 — vocoder 339
 — —, digitalization of 344
 — —, multiplexing of 344
 — —, parallel and cascade 343
 — —, voice excited 347
 — — synthesizer 266
 Fourier expansion of the speech spectrum 352, 357
 — series 213
 — transform, short time 142
 frequency-dividing vocoders 370

— division—multiplication 370–386
 — -equalizing network 217, 233
 fricative consonants 295
 fundamental frequency 285
 — —, limens for 281
 fusion, binaural 133

gas laws 30, 32
 General American (GA) dialect 17
 glides 21
 glottal area 45
 — — function, frequency spectrum of 49
 — excitation 41
 — impedance 14, 43, 63
 — inductance 64
 — orifice 41, 43
 — —, acoustic impedance of 249
 — resistance 44, 64
 — source 14, 41, 51, 53
 — —, equivalent circuit for 41, 50
 — volume flow 13, 14, 48
 — — —, spectral zeros of 48
 — — —, spectrum of 48
 — wave 165, 185
 — —, asymmetry of 279
 — —, approximations to 234, 240
 — —, duty factor of 279
 — —, open time of 244
 — —, simulation of 232
 — zeros, limens for 281
 — —, perceptual effects of 242
 glottis 11, 41
 —, area of 12, 45
 —, resistance of 44
 —, time constant for 47

hair cells, auditory 93, 94
 — —, inner and outer 95, 96
 Hamming window 361, 376
 hardware synthesizers 268
 harmonic compressor 377
 hearing 86
 —, transducer mechanism 86
 heat-conduction loss 25, 31, 34, 84
 helicotrema 92
 higher-order poles (of the vocal tract), spectral contribution of 217
 — — zero, spectral contribution of 220
 Hilbert transform 373, 376

- homomorphic vocoders 361
—, digitalization of 362
- impedance, driving point 51
—, glottal 43
—, radiation 36–38
— tube 190
- incus 88
- inductance, acoustic 28, 30
- inertance 28
—, acoustic 28, 66
- inferior colliculus 101
- information theory 3
- inner ear 87, 91
— —, mechanical impedance of 88
- integration, prediction by, in delta modulation 401
- intelligibility measures 277
— of speech 310
- inverse filtering 245
- kinesthetic communication 320
— feedback 9
- Laguerre function 355
— —, network realization of 359
- Laplace transform 73, 234
- larynx 11
- lateral lemniscus 101
- learning in speech perception 297
- linear interpolation 391
— prediction 391
— — vocoders 367
- linguistic association 297, 301
— constraints 8, 196
- lip constriction 231
- losses, heat conduction 25, 31, 34, 84
—, viscous 25, 28–30, 44
- lossy cylindrical pipe, equivalent circuit for 25–35, 66
- low-frequency vocoder 320
- L-section ladder network 273
- lungs 11, 42
- malleus 88
- maximum likelihood vocoders 363
— — —, formant tracking by 366
— — —, spectral estimation by 365
- mechanical oscillator 248
— speaking machines 205
- medial geniculate 101
- meromorphic functions 225
- microelectrode recordings (of auditory nerves) 101
- microphone theory (of auditory transduction) 99
- middle ear 87
— —, computational model 112
— — transmission 90, 113
- mimicry 203, 310
- minimum phase 165
— — function 60, 230
- mode pattern (of the vocal tract) 59
— —, effect of four-tube approximation on 80–83
— —, — of glottal impedance on 63
— —, — of nasal tract on 77
— —, — of radiation load on 61
— —, — of wall vibration on 65
- modulation, delta 401
— differential pulse code 395
— pulse code 337
- Mössbauer effects, used to measure basilar-membrane displacement 117
— —, used to study motion of basilar membrane 93
- motor theory of speech perception 308
- multi-dimensional scaling 312
- nasal cavity 11, 77
— consonants 77
— tract 11, 77
— —, size and damping of 204
- nasalized vowel 77, 221
- neural pathways (in the auditory system) 100
- neural volleys 127
- noise excitation (of the vocal tract) 255
- non-uniform pipe, approximation of 273
- normal modes of the vocal tract 59, 70
- nostrils 11
- “one-man TASI” 387
- optimum linear prediction 394, 397
- organ of corti 93, 94
— —, density of ganglion cells in 136
- orthogonal function vocoders 348
- orthonormal expansion of the autocorrelation function 354
— — of the speech spectrum 352
— — of the speech wave form 349
- ossicles, vibration of 89
- ossicular bones 88

- outer ear 87
- oval window 88
- parallel synthesizers 225, 228
- pattern-matching vocoders 332
— — playback machine 291
- PB (phonetically-balanced) words 311
- perception of speech 276
— —, mechanism of 204
- perceptual criteria 6
— dimensions 300
— units (of speech) 305
- perilymph 91
- periodic pulse signal, computer simulation of basilar-membrane response 122
— — train, pitch of 128
- peripheral ear 87
- pharynx 11, 24
- phase vocoder 378
— —, digital simulation of 381
— —, multiplexing of 384
— —, time expansion-compression by 384
- phonation 12, 246
- phoneme 15
— analysis 193
- phonemes, English 4
- phonetic alphabet 16
— symbol 16
— transcription 15, 16
- physiology of the vocal system 9–15
- π -network 27
- pitch, voice 13
— discrimination 128
—, automatic analysis of 184
— extraction by cepstrum 184
— percepts, bimodality of 130
— perception 127
— period, variation in 285
— signal 324
- plane progressive waves 274
— waves 25–28
- post-stimulus-time histogram 104
- power-law function, relating neural activity to mechanical displacement 127
— — model for loudness 139
— spectrum, average 160
— —, short-time 155
- predictive coding 390
— quantizing 395
- propagation constant 26, 66, 68
- Prony method 369
- prosodic features 269
— information 8
- psychoacoustics 277
- psychophysics 277
- quality tests for speech 312
- quantization 394
— of channel vocoder signals 330
— of formant signals 345
— noise 397
— — in delta modulation 402
- radiation factors (in the vocal system) 36, 61, 259
— impedance 36, 61
— — at the mouth and nostrils 36–38
— —, effect on mode pattern 61–63
— —, normalized acoustic 36
— load 36, 61, 62, 259
— pattern 39
— reactance 36, 63
— resistance 36, 63
- reciprocal inertance 66
- recognition of speakers 199, 204
- recursive digital filters 364, 368
- reflection coefficients 273
- Reissner's membrane 92
- resistance acoustic 28–30
—, flow-dependent 46
—, per-unit-length 30
- resolution of the basilar membrane 149
—, temporal vs. frequency 141
- resonagraph 154
- respiration 246
- reticular lamina 94
- Reynolds number 55, 251
- round window, displacement of 90
- saccule 91
- sawtooth oscillator 231
- scala media 92
— tympani 92
— vestibuli 92
- segmental information 270
- sequential constraints in language 4
- semantic constraints 305
- semi-circular canals 91
- semivowels 21
- sensitivity, auditory 136

- sensitivity of ear, mechanical 136
- sensory aids (for speech) 318
- "shadowing" (in speech) 310
- short-time amplitude spectrum 319
 - frequency analysis 142
- side-branch resonator 221
- signal dimensions (in perception) 279
- simple source 36
- slope overload in delta modulation 402
- sound distribution about a piston in a sphere 39
 - — — the head 38–41
 - — — spherical source 38
- generation (in the vocal tract), models for 246
 - pressure 28, 55
 - propagation in tubes 26
 - spectrogram 151
 - spectrograph 146, 150
 - velocity 34, 67, 84
 - wave, one-dimensional 25
- source entropy 4, 6
- speaker recognition 199, 204, 312
 - verification 201
- speaking machines 205
- specific heat 31, 35
- spectral analysis, pitch-synchronous 228
 - peaks 59
 - square-rooting 339
 - zeros 50
- spectrogram 151
- spectrograph 146, 150
- spectrographic displays 318
- spectrum, moments of 7, 165
 - reconstruction 211
 - , running 142
 - scanning 167
 - , short-time 142
 - , smoothing of 177
 - -shaping network 217, 233
- speech analysis 140
 - , automatic recognition of 192
 - , average power spectrum of 162
 - , non-minimum phase 165
 - synthesis 204
 - intelligibility 8
 - —, calculation of 315, 317
 - —, effects of signal-to-noise ratio on 304
 - —, relation to articulation index 315
 - naturalness 233
 - pathology 232
 - perception, discrimination of nasal and non-nasal consonants in 309
 - —, effects of context on 303
 - —, effects of restricted vocabulary on 304
 - —, models of 308
 - —, motor theory of 308
 - — of synthetic noise bursts 291
 - —, relation to speech production 308
 - —, supplementary sensory channels for 318
 - production 16
 - —, manner of 16
 - —, place of 16, 23
 - quality 8, 233
 - reading 318
 - recognition 192
 - shadowing 310
 - sounds 15–22
 - —, relative frequencies of 5
 - "speech stretcher" 378
 - synthesis 204
 - — by computer stimulation 260
 - —, electrical methods for 210
 - — from printed English text 269
 - spherical baffle 36
 - source 38
 - —, radiation load on 36
 - —, sound field around 36, 39
 - spiral ganglion 101
 - stapes 88
 - displacement 91
 - footplate, volume displacement of 90
 - statistical constraints of a language 16
 - step-size in delta modulation 401
 - — in quantizing 397
 - stroboscopic illumination of the vocal cords 13
 - subglottal pressure 12, 43, 48
 - system 11, 41–43
 - superior olive 101
 - syllable synthesis 301
 - syntax analysis 269
 - syntactic constraints 305
 - synthetic fricatives 295
 - nasals, perception of 291
 - speech 315
 - synthesis-by-rule 268

- tactile communication 320
 - vocoder 319
- T-circuit equivalent 229
- TASI 386
 - , "one man" 387
- tectorial membrane 94
- telephone ringing signal 313
- telephony, analysis-synthesis 8
 - , early development of 2
- terminal analog synthesizers 214
- threshold of audibility, binaural 138
 - sensitivity 136
- thyroid cartilage 11, 12
- time-assignment speech interpolation 386
 - -division transmission of speech 386
 - — — by phase vocoder 384
 - — — by speech stretcher 378
- T-network 27, 66
- tongue hump 17
- tonotopic organization 96, 106
 - — of auditory system 101
- trachea 11, 42
- transcendental meromorphic functions 215
- transmission-line analog of basilar-membrane motion 123
 - —, non-uniform 229
 - systems, subjective evaluation of 310
- travelling wave, on basilar membrane 93
- triangular waves 234
- trigram frequencies 4
- Tschebyscheff polynomials 360
- tuning curve 102
- turbulent flow 14, 53, 54–58
- tympanic membrane 88
 - muscles 89
- unvoiced and whispered sounds 231
 - excitation 245
- utricle 91
- velum 11
- verification of speakers 201
- vestibular apparatus 91
- viscosity of air 28
- viscous loss 25, 28–30, 45
- visible speech translator 154, 318
- Voback 211
- Vobanc 371
- vocal constriction 17
 - —, alveolar 18
 - —, dental 18
 - —, glottal 18
 - —, labio-dental 18
 - —, palatal 18
 - —, velar 18
 - cords 10, 11–14, 190
 - —, duty factor of 13
 - —, one-mass model of 251
 - —, two-mass model of 251
 - system, transmission-line analogs of 229
 - tract 9–85
 - —, acoustic properties of 23–85
 - —, computer simulations of 85
 - —, damping of 182
 - —, driving-point impedance of 51–53
 - —, dynamic model of 269
 - —, effects of nasal tract on 77–79
 - —, electrical analogs of 85
 - —, four-tube approximation of 80–83
 - —, glottal excitation of 41–43
 - —, impedance of 190
 - —, length in man 24
 - —, mechanical analogs of 207
 - —, models of 191
 - —, mode pattern of 59
 - —, multi-tube approximation of 83–85
 - —, noise excitation of 53–55, 72–77
 - —, non-glottal excitation of 219
 - —, non-linear flow phenomena in 210
 - —, physiology of 9–15
 - —, profiles of 18–22
 - —, shape of 187
 - —, size and shape of 204
 - —, terminal properties of 214
 - —, transfer functions for 215
 - —, transient excitation of 53–54, 56–58
 - —, transmission characteristics of 58–85
 - —, two-tube approximation of 69–83
 - —, X-rays of 187

- vocal tract simulation, digital techniques
for 272
— transmission, frequency spectrum of
61
vocoders 320, 323, 333, 337, 339, 348,
361, 363, 367, 370
—, time-domain 337, 354, 363, 367
Voder 211
voice communication 1
— -excited vocoders 333
— — —, digitalization of 336
— — —, multiplexing of 336
— pitch 13
— prints 201
— towers 2
volume velocity 230
vowels 4, 17
—, articulatory configuration of 17
- , formant frequencies of 70–72
—, Japanese 289
- wave equation, one-dimensional 25
— motion in tubes 25
waveform principle 3
— transmission 316
WEBSTER horn equation 25, 269
whispered speech 15
word concatenation, synthesis by 271
- zero crossings, relation of to formant
frequencies 165
zeros of the glottal source 48
— of transmission 73, 79
—, spectral 50, 73, 79
z-transform 276

Kommunikation und Kybernetik in Einzeldarstellungen

Herausgegeben von H. Wolter und W. D. Keidel

- 1. Band: Grundlagen und Anwendungen der Informationstheorie**
Von W. Meyer-Eppeler
2. Auflage neu bearbeitet und erweitert von G. Heike und K. Löhn
Mit 205 Abbildungen und 1 Tafel. XXVII, 549 Seiten. 1969
Gebunden DM 98,—
- 2. Band: Structural Linguistics and Human Communication**
An Introduction into the Mechanism of Language
and the Methodology of Linguistics.
By B. Malmberg
2nd revised edition. With 88 figures. VIII, 213 pages. 1965
Cloth DM 40,—
- 4. Band: The Advanced Theory of Language as Choice and Chance**
By G. Herdan
With 30 figures. XVI, 459 pages. 1966
Cloth DM 62,—
- 5. Band: Linguistische Einheiten im Rahmen der modernen Sprachwissenschaft**
Von G. Hammarström
Mit 5 Abbildungen. VIII, 109 Seiten. 1966
Gebunden DM 26,—
- 6. Band: Einführung in die allgemeine Informationstheorie**
Von J. Peters
Mit 75 Abbildungen. XII, 266 Seiten. 1967
Gebunden DM 64,—
-