

A

- AD1847 585. *See also* SoundPort interfaces
- AD1849 572, 578. *See also* SoundPort interfaces
- Adaptive equalizer 84
 - architectures 105
 - complex 106
 - complex filter listing 109
 - decision-directed adaptation 115
 - flowchart 112
 - history 98
 - least mean squared (LMS) algorithm 84, 109
 - LMS routine 111
 - performance index 105
 - practical considerations 119
 - real 106
 - sampling rates 107
 - theory of 102
 - training sequence 114
- Adaptive predictor 296, 297
- Adaptive quantizer 296, 297
- Adaptive sample rate decimation 218
- ADPCM (G.721) 293
 - implementation 300
 - receiver 298
 - subroutines 301
 - transmitter 294
- ADSP-2100 family
 - ADSP-2101 architecture 7
 - base architecture 4
 - data memory address (DMA) bus 6
 - data memory data (DMD) bus 6
 - overview 1
 - program memory address (PMA) bus 6
 - program memory data (PMD) bus 6
 - result (R) bus 7
- ADSP-2101 1. *See also* ADSP-2100 family
- ADSP-2101 architecture 7. *See also* ADSP-2100 family
 - on-chip memory 7
 - programmable timer 9
 - serial ports ("SPORTs") 8

Index

ADSP-2111 2. *See also* ADSP-2100 family
ADSP-2111 architecture 9. *See also* ADSP-2100 family
 host interface port (HIP) 9
ADSP-21msp50/5x 2. *See also* ADSP-2100 family
ADSP-21msp5x architecture 10. *See also* ADSP-2100 family
 analog interface 10
 codec 10
ALU 2, 4. *See also* ADSP-2100 family, base architecture
Answer mode descrambler 23. *See also* V.32
Answer mode scrambler 23. *See also* V.32
APCM inverse quantization 219
APCM quantization 218
Arithmetic/logic unit 2, 4
Assembly language 11
Auto-correlation 209
Autobaud 561, 564

B

Barrel shifter 2, 4. *See also* ADSP-2100 family, base architecture
Baud rate 561, 564
Bilinear transformation 514
Biquad filter 525. *See also* IIR biquad filter
Boot pages 637. *See also* Memory interfacing
Booting through the serial port 631. *See also* Loading through SPORT
Buses 6. *See also* ADSP-2100 family

C

Call mode descrambler 23. *See also* V.32
Call mode scrambler 22. *See also* V.32
Cepstral coefficients 338
Channel equalization 101
Circular buffers 544. *See also* Modulo addressing
Comfort noise insertion (CNI) 205. *See also* GSM
Companding
 A-law 293
 μ -law 293
Continuous phase frequency-shift keyed modulation 120
 flow diagram 122
 implementation 121
 listing 125
 methodology 120
Control systems 503. *See also* Digital control systems
Convolutional code 37. *See also* Trellis coding

Index

D

- Data address generator 5
- Data scrambler 18, 127, 152
- DCT 443. *See also* Discrete cosine transform
- Decoder 220, 294. *See also* GSM
 - higher sub-band decoder 298
 - lower sub-band decoder 299
- Descrambler 22. *See also* V.32
 - programs 25
- Development system
 - Assembler 13
 - C Compiler 14
 - EZ-ICE® 13
 - EZ-LAB® 13
 - Linker 13
 - PROM Splitter 14
 - Simulator 14
 - System Builder 13
- Digital control system *See also* N'th order digital controllers
 - ADSP-2101-based actuator controller 506
 - benchmarks 522
 - hardware implementation 505
 - model 504
 - overview 503
 - PID controller 511
 - software implementation 507
- Digital mobile radio (DMR) 205. *See also* GSM
- Digital tone detection 481. *See also* Goertzel algorithm
- Discrete cosine transform (DCT) 443
 - benchmark times 447
 - comparison with Fourier transform 445
 - computational methods 449
 - indirect computation 449
 - listings 455
 - transform coefficients 444
 - two-dimensional DCT 448
 - zig-zag scanning of DCT coefficients 453
- Double-precision IIR biquad 531, 534
- Double-precision multiply routine 529

Index

DRAM

- CAS 608, 610
 - fast page mode 613
 - listings 618
 - multiplexed memory addressing 607
 - OE 611
 - page mode 613
 - RAS 608, 609
 - read timing 611
 - read/write timing 607, 608
 - refresh 614
 - refresh timing 615
 - WRITE 611
 - write timing 612
- Dynamic time warping 333, 342
- time warping boundaries 344

E

Echo cancellation

- algorithm 82
- benchmarks 97
- flowchart for LMS stochastic gradient algorithm 85
- frequency offset compensation 88
- implementation of LMS algorithm 84
- LMS adaptive filter block diagram 84
- LMS stochastic gradient code listing 88
- telephone channel block diagram 81

Encoder 207, 294. *See also* GSM

- circular buffering 300
- higher sub-band encoder 296
- lower sub-band encoder 296

End point detection 337

Equalizer 105. *See also* Adaptive equalizer

EZ-LAB® Evaluation Board 604, 617

F

Filter coefficients 158

G

Goertzel algorithm

- benchmarks 489
- detection time 484
- frequency resolution 484
- Goertzel coefficients 488
- leakage loss 483
- single tone detection 484, 485
- symbol detection 484

Index

- Group special mobile (GSM) 205
 - benchmarks 222
 - decoder 220
 - encoder 207
 - listings 223
 - long term prediction (LTP) 207
 - speech codec 205
 - voice activity detection 205

H

- Hardware interfacing 571
 - AD1847 585
 - AD1849 572, 578
 - DRAM 603
 - memory 603
 - SoundPorts 571
- Hilbert transform 90
 - implementation 91
 - listing 96
- Hou's fast discrete cosine algorithm 449. *See also* Discrete cosine transform
- Human speech production
 - excitation 330
 - filtering 330

I

- IIR biquad filters 525. *See also* Multiprecision filters
 - biquad filter subroutine 525
 - filter characteristics 549
 - optimized 16-bit biquads 544
 - optimized basic biquad filter routine 546
 - second-level optimized biquad filter routine 548
 - second-order biquad 525
- Image compression
 - applications of 443
- Index registers 454
- Interfacing 571. *See also* Hardware interfacing
- Inverse adaptive quantizer 298, 299
- Isolated word recognition 340

L

- Least mean squared (LMS) algorithm 84
- Levinson-Durbin recursion 175
- Linear prediction
 - filter 157
 - filter coefficients 158
 - speech synthesis filter 158

Index

- Linear predictive coding (LPC) 205, 207, 331
 - 2.4 kbits/s 163
 - 7.8 kbits/s 159
 - analysis 336, 338
 - parameters 158
 - predictor coefficients 338
 - synthesis 158
- loader
 - loader option 638
- Loading through SPORT
 - flow diagram 633
 - implementation 632
 - listing 636
- Logarithmic-area-ratios (LAR)
 - coding of 212
 - decoding of 212
 - quantization 212
 - transformation of 214
- Long term analysis filtering 216
 - cross-correlation 216
 - long term correlation lag 216
- Long term prediction (LTP) 207. *See also* GSM
- Long term synthesis filtering 217, 221
- LPC
 - 2.4 kbits/s 163
 - 7.8 kbits/s 159
 - parameters 158
 - synthesis 158
- LPC analysis 336, 338

M

- Memory buses 6. *See also* ADSP-2100 family
- Memory interfacing
 - loader option 638
 - boot pages for program memory 637
 - DRAM 603
 - hardware implications 640
 - SRAM 603, 637
 - use of the C-Compiler 641
 - using external PM ROM 640
 - using internal & external PM RAM for code 639
- Modem 17
- Modulation 75, 140. *See also* Modem
- Modulo addressing 544
- Monitor 631. *See also* Loading through SPORT

Index

Multiplier/accumulator (MAC) 2, 4. *See also* ADSP-2100 family, base architecture
Multiprecision filters 527. *See also* IIR biquad filters
 double-precision IIR biquad 531, 534
 double-precision multiply routine 529
 half, double-precision IIR biquad subroutine 539
 half, triple-precision IIR biquad subroutine 543
 multiprecision multiplication 528
 optimized double-precision IIR biquad subroutine 537

N

Notch filter
 example 520
 routine 522
N'th order digital controllers
 analog-controller-based digital design 513
 bilinear transformation 514
 fourth-order direct form controller 517
 implementation 517
 second-order biquad section 515
 state-space design 515
 structures 515
Nyquist theory 482

O

Optimized filters 544. *See also* IIR biquad filters

P

Parameters for LPC
 excitation 158
 filter coefficients 158
 gain 158
PID controller
 backward difference 509
 design 508
 implementation 511
 Kd 509
 Ki 509
 Kp 509
 routine 512
Pre-emphasis filtering 208
Predictor coefficients 338
Program sequencer 5. *See also* ADSP-2100 family, base architecture
Pulse shape filter routine 19, 138

Index

Q

Quadrature amplitude modulation (QAM)

- block diagram 76
- demodulator block diagram 77
- demodulator code listing 80
- implementation 78
- methodology 75

Quadrature mirror filter 294

- receive 300
- transmit 294

R

Raised cosine filter 32

- formula 33
- implementation 33
- rolloff factor 33

Random number generator routine 139

Recognition 329. *See also* Speech recognition

Recognition library 331

Reflection coefficients

- coefficients 210

Regular pulse excitation (RPE) 207. *See also* GSM

- adaptive sample rate decimation 218
- APCM inverse quantization 219
- APCM quantization 218
- encoding 217
- reconstructed short term residual signal 219
- weighting filter 217

Rounding (for GSM)

- multiply with rounding 206

RS.232 552. *See also* UART

S

Sampling frequency for digital tone detection

- good sampling frequency 485
- maximum error-squared value 482
- Nyquist theory 482
- selecting sampling frequency 482

Schur recursion 209, 210, 336

Scrambler 21. *See also* V.32

- programs 25

Serial port

- loading the ADSP-2101 631
- using as UART 551

Index

- Shifter 4. *See also* ADSP-2100 family, base architecture
- Short term analysis filtering 213, 215
- Short term synthesis filtering 220
- Signal modulation routine 75, 140
- signal_map 46
- Software tools 13. *See also* Development system
- SoundPort interfaces
 - ADSP-2101/AD1847 585
 - ADSP-2101/AD1847 demonstration routine 602
 - ADSP-2101/AD1847 talk-through routine 589
 - ADSP-2105/AD1849 578
 - ADSP-2105/AD1849 talk-through routine 584
 - ADSP-2111/AD1849 572
 - ADSP-2111/AD1849 talk-through routine 577
- Speech codec 205. *See also* GSM
- Speech compression
 - ADPCM 293
 - GSM 205
 - LPC 157
- Speech recognition
 - demonstration shell 346
 - executive shell 346
 - filter 331
 - hardware implementation 349
 - K-Nearest Neighbor 341
 - recognition library 331
 - recognition phase 330, 333
 - software implementation 334
 - speaker dependent systems 330, 332
 - speaker independent systems 330, 332
 - theory of 330
 - training phase 330, 332
- Speech synthesis filter 158
- SRAM 637
- Sub-band ADPCM (G.722) 293. *See also* ADPCM
 - subroutine descriptions 301

Index

T

- Timer interrupt routine 561
- Tone detection applications *See also* Goertzel algorithm
 - DTMF 481, 484
 - remotely controlled equipment 481
- Trellis encoding 37
 - block diagram 38
 - convolutional encoder 41
 - convolutional encoder block diagram 41
 - convolutional encoder routine 45
 - differential encoder 40
 - differential encoder lookup table 40
 - implementation 39
 - Trellis encoder program 43

U

- UART
 - autobaud 561, 564
 - baud rate 561, 564
 - character echo example 567
 - example system configuration 552
 - full-duplex operation 551
 - initialization routine 553
 - interrupts 552
 - receive character routine 563
 - RS-232 line driver 551
 - timer 552
 - timer interrupt routine 553
 - transmit character routine 563
- Unvoiced sound 157, 158
- Unvoiced speech 330

V

- V.27 ter
 - 4-point V.27 ter constellation 129
 - 4-point V.27 ter phase changes 128
 - 8-point V.27 ter constellation 128
 - 8-point V.27 ter phase changes 127
 - data acquisition routine 134
 - data scrambler 18, 127, 152
 - data scrambler routine 135
 - IQ generator routine 137
 - main V.27 ter routine 133
 - pulse shape filter routine 19, 138
 - random number generator routine 139
 - signal modulation routine 75, 140
 - transmitter 126

Index

V.29

- 8-point V.29 phase changes 141
- constellation 142, 143
- data acquisition routine 151
- data scrambler routine 152
- IQ generator routine 154
- main V.29 routine 150

V.32

- adaptive equalization 98. *See also* Adaptive equalizer
- adaptive equalizer 20
- descrambler 21, 22
- differential decoder 21
- echo cancellation 81
- programs 25
- pulse shape filters 19. *See also* Raised cosine filter
- quadrature amplitude modulation (QAM) 75
- recommendation 17
- scrambler 18, 21
- signal mapping 19
- transmitter 18
- Viterbi decoder 21
- Viterbi decoding 47

Viterbi algorithm 50

Viterbi decoding. *See* V.32

- algorithm 50
- implementation 52
- last surviving path 55
- listing 74
- shortest path 53, 55
- state diagram 48
- state table 48
- trellis diagram 49

Vocal fold vibration 157

Vocal tract 157

Voice activity detection (VAD) 205. *See also* GSM

Voice recognition 330. *See also* Speech recognition

Voiced sound 157, 158

Voiced speech 330

W

Weighing filter 217

Wide-band ADPCM 293. *See also* ADPCM (G.722)

Z

Zig-zag scanning of DCT coefficients 453