INTERNATIONAL TELECOMMUNICATION UNION

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TELECOMMUNICATION
STANDARDIZATION SECTOR
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G.729

Annex C
(09/98)

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ITU-T Recommendation G.729 – Annex C

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.729

CODING OF SPEECH AT 8 kbit/s USING CONJUGATE-STRUCTURE ALGEBRAIC-CODE-EXCITED-LINEAR-PREDICTION (CS-ACELP)

ANNEX C

Reference floating-point implementation for G.729 CS-ACELP 8 kbit/s speech coding

Summary

This Annex describes an alternative implementation of G.729 Annex A based on floating-point arithmetic. Subjective quality tests have been performed by NTT (Japan) and CNET (France) to assess the quality of these floating-point versions under various conditions (input level, error, background noise, tandeming). Different interoperability configurations with the fixed-point version of the algorithm have also been tested. These tests proved full interoperability of this floating-point implementation to both Recommendation G.729 and its Annex A. The design of a set of test vectors remains for further study.

Source

Annex C to ITU-T Recommendation G.729 was prepared by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 25th of September 1998.

FOREWORD

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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ANNEX C

Reference floating-point implementation for G.729 CS-ACELP 8 kbit/s speech coding

(Geneva, 1998)

C.1 Scope

This Annex provides a description of an alternative implementation in floating-point arithmetic for Recommendation G.729 and its Annex A. The development of an interoperable floating-point specification for Voice Activity Detection (VAD), Discontinuous Transmission/Silence Compression (DTX) and Comfort Noise Generation (CNG) with similar properties as the fixed-point specification in Annex B/G.729 is for further study.

C.2 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.729 (1996), *Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP).*

[2] ITU-T Recommendation G.729/Annex A (1996), *Reduced complexity 8 kbit/s CS-ACELP speech codec.*

C.3 Overview

Recommendation G.729 provides bit-exact, fixed-point specification of an algorithm for the coding of speech signals at 8 kbit/s. Its Annex A is a reduced complexity version interoperable with Recommendation G.729. Exact details of these specifications are given in bit-exact, fixed-point C code available from the ITU-T. This Annex describes and defines an alternative implementation of Recommendation G.729 and G.729 Annex A based on floating-point arithmetic.

C.4 Algorithmic description

This floating-point version of Recommendation G.729 (respectively G.729 Annex A) has the same algorithm steps as the fixed-point version. Similarly, the bit stream is identical to that of G.729 (respectively to that of G.729 Annex A). For algorithmic details, see Recommendation G.729 (respectively G.729 Annex A).

C.5 ANSI C code

ANSI C code simulating the floating-point version of Recommendation G.729 (respectively G.729 Annex A) defined in this Annex has been developed and is available as an attachment to this Annex. The ANSI C code represents the normative specification of this Annex. The algorithmic description given by the C code shall take precedence over the texts contained in the main body of Recommendation G.729, Annex A/G.729 or this Annex. The current version of this ANSI C source code is Version 1.01 of 15 September 1998. The structure of these floating-point source codes is related to the corresponding fixed point source code. As for G.723.1 Annex B, the typedef.h file contains a statement enabling the definition of all floating-point variables and constants as type either double or single. A file called version.h is available to select whether the C code will operate according to Recommendation G.729 or G.729 Annex A. Tables C.1 to C.3 give the list of the software files names with a brief description. Note that the fixed point files basic_op.c, oper_32b.c, dspfunc.c and basic_op.h, oper_32b.h are not needed for floating-point arithmetic. A float to short conversion routine has been added to the file util.c.

Table C.1/G.729 – List of software files specific to G.729 floating-point source code

File name	Description	File size (in bytes)
coder.c	main program for G.729 encoder	4 591
cod_ld8k.c	G.729 encoder routine	19 336
acelp_co.c	G.729 fixed codebook search	23 318
lpc.c	G.729 LP analysis	9 470
lpcfunc.c	miscellaneous routines related to LP filter	5 470
pitch.c	G.729 pitch search	14 270
pwf.c	G.729 computation of perceptual weighting coefficients	3 849
decoder.c	main program for G.729 decoder	5 235
dec_ld8k.c	G.729 decoder routine	9 219
postfil.c	G.729 postfilter	23 554
tab_ld8k.c	G.729 constants tables	33 179
ld8k.h	G.729 prototypes and constant declarations	16 238
tab_ld8k.h	G.729 declaration of constants tables	1 675
version.h	used to select the G.729 (main body) mode	916

Table C.2/G.729 – List of software files specific to G.729 Annex A floating-point source code

File name	Description	File size (in bytes)
coder.c	main program for G.729 Annex A encoder	4 514
acelp_ca.c	G.729 Annex A fixed codebook search	25 238
cod_ld8a.c	G.729 Annex A encoder routine	18 453
lpc.c	G.729 Annex A LP analysis	9 535
lpcfunc.c	miscellaneous routines related to LP filter	4 019
pitch_a.c	G.729 Annex A pitch search	12 468
decoder.c	main program for G.729 Annex A decoder	5 043
dec_ld8a.c	G.729 Annex A decoder routine	9 473
postfila.c	G.729 Annex A postfilter	12 949
tab_ld8a.c	G.729 Annex A tables of constants	32 830
ld8a.h	G.729 Annex A prototypes and constant declarations	17 449
tab_ld8a.h	declaration of G.729 Annex A constants tables	1 295
version.h	used to select the G.729 Annex A mode	931

Table C.3/G.729 – List of software files common to G.729 and G.729 Annex A floating-point source code

File name	Description	File size (in bytes)
bits.c	bit manipulation routines	4 644
qua_lsp.c	LSP quantizer	11 953
qua_gain.c	gain quantizer	7 402
cor_func.c	miscellaneous routines related to excitation computation	2 603
de_acelp.c	algebraic codebook decoder	2 014
dec_gain.c	gain decoder	3 247
dec_lag3.c	adaptive codebook index decoder	2 412
filter.c	filter functions	3 634
gainpred.c	gain predictor	4 363
lspdec.c	LSP decoding routine	3 852
lspgetq.c	LSP quantizer	6 815
p_parity.c	pitch parity computation	2 036
post_pro.c	post-processing (HP filtering)	2 906
pre_proc.c	pre-processing (HP filtering)	2 909
pred_lt3.c	generation of adaptive codebook	2 424
taming.c	pitch taming functions	3 396
util.c	utility function	3 292
typedef.h	data type definition (machine dependent)	1 504

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