

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
27 February 2003 (27.02.2003)

PCT

(10) International Publication Number
WO 2003/017084 A3

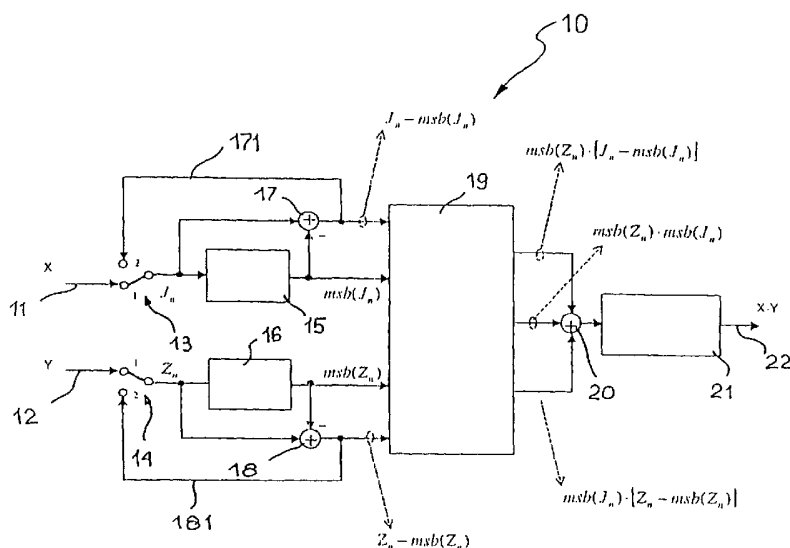
- (51) International Patent Classification⁷: **G06F 7/52**
- (21) International Application Number: PCT/IT2002/000540
- (22) International Filing Date: 14 August 2002 (14.08.2002)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
TO2001A000817 17 August 2001 (17.08.2001) IT
- (71) Applicant (for all designated States except US): **TELECOM ITALIA S.P.A.** [IT/IT]; Via Reiss Romoli, 274, I-10148 Torino (IT).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **ETTORRE, Donato** [IT/IT]; c/o Telecom Italia Lab S.p.A., Via Reiss Romoli, 274, I-10148 Torino (IT). **MELIS, Bruno** [IT/IT]; c/o Telecom Italia Lab S.p.A., Via Reiss Romoli, 274, I-10148 Torino (IT). **RUSCITTO, Alfredo** [IT/IT]; c/o Telecom Italia Lab S.p.A., Via Reiss Romoli, 274, I-10148 Torino (IT).
- (74) Agents: **GIANNESI, Pier Giovanni** et al.; Pirelli S.P.A., Viale Sarca, 222, I-20126 Milano (IT).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,

[Continued on next page]

(54) Title: MULTIPLIER CIRCUIT



(57) **Abstract:** An iterative multiplier circuit (10) comprises modules (15 to 18) that subdivide the respective input signals (Z_n , J_n) into a first part ($\text{msb}(Z_n)$, $\text{msb}(J_n)$) that is the power of 2 immediately lower or equal to the input signal and a second part ($Z_n - \text{msb}(Z_n)$, $J_n - \text{msb}(J_n)$) corresponding to the difference between the input signal and the aforesaid first part. A shift module (19) generates a respective output signal through shift operations that implement the multiplication operation for numbers that are powers of 2. The circuit operates according to a general iterative scheme in which at each step three components of the output signal ($X.Y$) are computed, corresponding to the product of two numbers that are powers of 2 and to two products in which at least one of the factors is a power of 2. The number of steps in the iteration scheme is controllable, thus allowing to vary the accuracy with which the output value ($X.Y$) is calculated.



- CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
- of inventorship (Rule 4.17(iv)) for US only

Published:

- with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:

31 December 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 02/00540

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F7/52

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 022 (P-424), 28 January 1986 (1986-01-28) & JP 60 175142 A (FUJITSU KK), 9 September 1985 (1985-09-09) abstract	1,7
A	US 5 008 850 A (JENSEN ERIC H) 16 April 1991 (1991-04-16) abstract	1,7
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *8* document member of the same patent family

Date of the actual completion of the international search

24 October 2003

Date of mailing of the international search report

05/11/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Cohen, B

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 02/00540

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KIDAMI S S ET AL: "AREA-EFFICIENT MULTIPLIERS FOR DIGITAL SIGNAL PROCESSING APPLICATIONS" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II: ANALOG AND DIGITAL SIGNAL PROCESSING, IEEE INC. NEW YORK, US, vol. 43, no. 2, 1 February 1996 (1996-02-01), pages 90-95, XP000559784 ISSN: 1057-7130 paragraph '00II! -----	1,7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT 02/00540

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 60175142	A	09-09-1985	NONE	
US 5008850	A	16-04-1991	AU 639329 B2	22-07-1993
			AU 7637991 A	28-11-1991
			JP 3271120 B2	02-04-2002
			JP 4232528 A	20-08-1992
			KR 9408614 B1	24-09-1994