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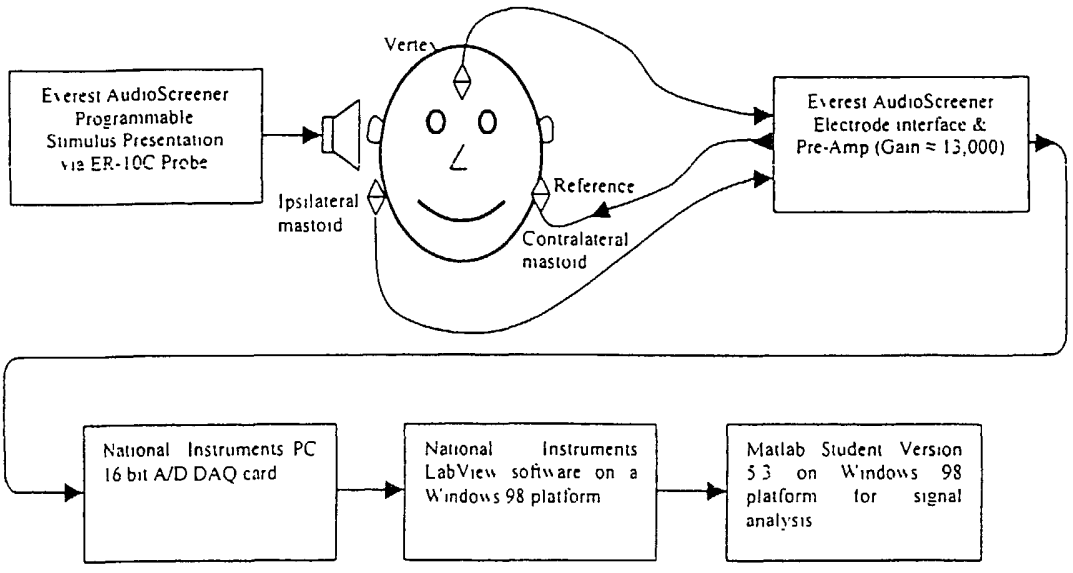
— *with international search report*

[Continued on next page]

(54) **Title:** FAST ESTIMATION OF WEAK BIO-SIGNALS USING NOVEL ALGORITHMS FOR GENERATING MULTIPLE ADDITIONAL DATA FRAMES



(57) **Abstract:** A method and apparatus for de-noising weak bio-signals having a relatively low signal to noise ratio utilizes an iterative process of de-noising a data set comprised of a new set of frames. The method separately performs a non-linear de-noising operation on each of the component frames and combines the resultant de-noised frames to form a combined resultant de-noised input signal. The method is preferably carried out in a digital processor.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/09711

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04B 15/00; H03G 5/00; G01L 21/02
US CL : 381/94.1,94.2,98;704/226

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)
U.S. : 381/94.1,94.2,98

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 practicable, search terms used)
IEEE Explorer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,388,182 A (BENEDETTO et al.) 07 February 1995 (07.02.1995), columns 7 and 8	1,12
Y	US 5,781,881A (STEGMANN) 14 July 1998 (14.07.1998) column 2, lines 46-65	1-4
Y	US 6,647,252 B2 (SMITH et al.) 11 November 2003 (11.11.2003), column 3, lines 44-56	1
Y	US 5,781,144 A (HWE) 14 July 1998 (14.07.1998) see abstract	1,12
Y	US 6,094,050 A (ZARUBI et al.) 25 July 2000 (25.07.2000) see abstract	1,12
A	Donoho, D. L. De-noising by Soft-Thresholding. IEEE Transactions on Information Theory. May 1995, Vol. 41., No. 3	
A	Zhang, Yu. Doppler Ultrasound Signal Denoising Based on Wavelet Frames. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control. May 2001, Vol. 48, No. 3	
A	US 5,697,379 A (NEELY et al.) 16 December 1997 (16.12.1997)	

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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INTERNATIONAL SEARCH REPORT

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Izworski, A. Nonlinear Processing of Auditory Brainstem Response. 2001 Proceedings of the 23rd annual EMBS Internations Conference. October 25-28, 2001.	