

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
6 December 2007 (06.12.2007)

PCT

(10) International Publication Number
WO 2007/138544 A3

- (51) International Patent Classification:
G01V 1/30 (2006.01) G01V 1/28 (2006.01)
- (21) International Application Number:
PCT/IB2007/051994
- (22) International Filing Date: 25 May 2007 (25.05.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/803,230 25 May 2006 (25.05.2006) US
60/894,182 9 March 2007 (09.03.2007) US
60/894,685 14 March 2007 (14.03.2007) US
11/748,473 14 May 2007 (14.05.2007) US

AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

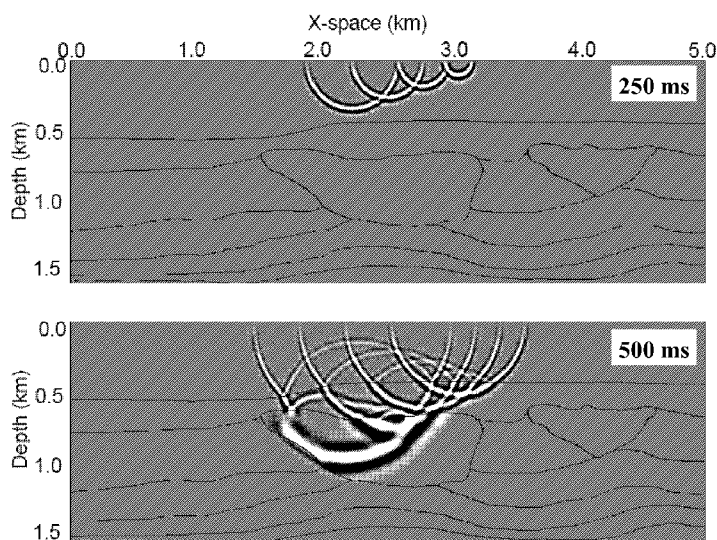
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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:
14 February 2008

(54) Title: CODING AND DECODING: SEISMIC DATA MODELING, ACQUISITION AND PROCESSING



(57) Abstract: A method for coding and decoding seismic data acquired, based on the concept of multishooting, is disclosed. In this concept, waves generated simultaneously from several locations at the surface of the earth, near the sea surface, at the sea floor, or inside a borehole propagate in the subsurface before being recorded at sensor locations as mixtures of various signals. The coding and decoding method for seismic data described here works with both instantaneous mixtures and convolutive mixtures. Furthermore, the mixtures can be underdetermined [i.e., the number of mixtures (K) is smaller than the number of seismic sources (I) associated with a multishot] or determined [i.e., the number of mixtures is equal to or greater than the number of sources]. When mixtures are determined, we can reorganize our seismic data as zero-mean random variables and use the independent component analysis (ICA) or, alternatively,

the principal component analysis (PCA) to decode. We can also alternatively take advantage of the sparsity of seismic data in our decoding process. When mixtures are underdetermined and the number of mixtures is at least two, we utilize higher-order statistics to overcome the underdeterminacy. Alternatively, we can use the constraint that seismic data are sparse to overcome the underdeterminacy. When mixtures are underdetermined and limited to single mixtures, we use *a priori* knowledge about seismic acquisition to computationally generate additional mixtures from the actual recorded mixtures. Then we organize our data as zero-mean random variables and use ICA or PCA to decode the data. The *a priori* knowledge includes source encoding, seismic acquisition geometries, and reference data collected for the purpose of aiding the decoding processing. The coding and decoding processes described can be used to acquire and process real seismic data in the field or in laboratories, and to model and process synthetic data.

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A. CLASSIFICATION OF SUBJECT MATTER*G01V 1/30(2006.01)i, G01V 1/28(2006.01)i*

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 8 G01V 1/30, 1/28

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

Korean utility models and applications for utility models since 1975

Japanese utility models and applications for utility models since 1975

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

eKIPASS (KIPO internal), NDSL

keywords: "multishooting", "seismic", "multishot" and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y ----- A	US 6327537 B1 (IKELLE, LUC T.) 4 December 2001 see abstract; column 5, line 55 - column 7, line 3; column 9, lines 24-67; column 11, line 63-column 12, line 9; Figures 5 and 6.	14, 21, 22 ----- 1, 2 ----- 3-13, 15-20, 23
Y	PRENSKY, S. E. A Survey of Recent Developments and Emerging Technology in Well Logging and Rock Characterization. The Log Analyst. 1994, Vol. 35, No. 2, pages 14-45. see section "Transmission (Full Waveform).	1
Y	IKELLE, L. T. & AMUNDSEN, L. Introduction to Petroleum Seismology. Society of Exploration Geophysicists, 2005, ISBN 1-56080-129-8, Chapters 10, 11. see Chapters 10 and 11.	2
A	van Pul, C. et al. A Comparison Study of Multishot vs. Single-Shot DWI-EPI in the Neonatal Brain: Reduced Effects of Ghosting Compared to Adults. Magnetic Resonance Imaging. 2004, Vol. 22, Pages 1169-1180. see the whole document.	1-23

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search

11 DECEMBER 2007 (11.12.2007)

Date of mailing of the international search report

11 DECEMBER 2007 (11.12.2007)

Name and mailing address of the ISA/KR

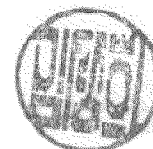
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Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

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Telephone No. 82-42-481-5499



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2007/051994

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US6327537B1	04. 12. 2001	None	