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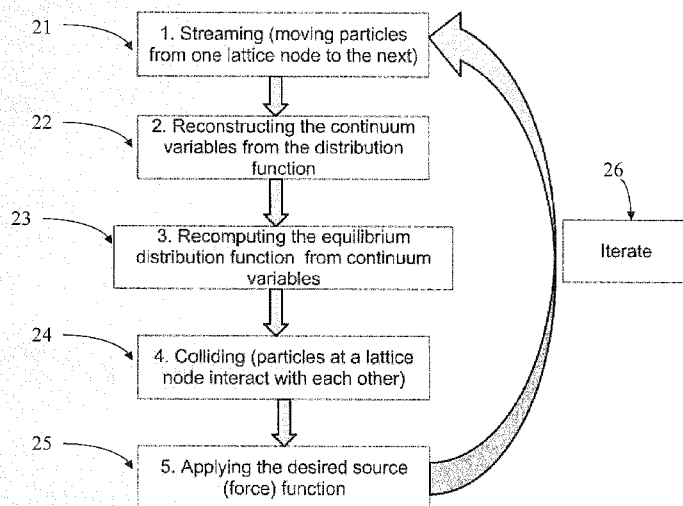
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(54) **Title:** WAVE PROPAGATION AND IMAGING METHOD



(57) **Abstract:** According to a first preferred embodiment of the present invention, there is provided an efficient method of computing synthetic wavefields. In the preferred arrangement, wavefields are computed by means of the Lattice Boltzmann Method (LBM) by increasing the number of degrees of freedom to be greater than the order of the lattice. This new degree of freedom is referred to as colour. Thus, particles in the present invention are fully defined by position, speed, direction and colour. In a preferred embodiment, the present invention is used to image of seismic or electromagnetic wavefield data through forward propagating and back propagating source and receiver wavefields followed by applying an imaging condition. In another preferred embodiment, the present invention is used to invert seismic or electromagnetic wavefield data through an iterative scheme where the difference between modelled and recorded data is minimized by updating an Earth model until the misfit is sufficiently small.

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2014/000012

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01V1/30 G01V3/38
ADD.
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)
G01V
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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	G S O'BRIEN ET AL: "A Lattice Boltzmann Method for Elastic Wave Propagation in a Poisson Solid", SEISMOLOGICAL SOCIETY OF AMERICA. BULLETIN, SEISMOLOGICAL SOCIETY OF AMERICA, US, vol. 102, no. 3, 1 June 2012 (2012-06-01), pages 1224-1234, XP008174245, ISSN: 0037-1106, DOI: 10.1785/0120110191 abstract figure 1 page 1230, left-hand column, last paragraph - page 1230, right-hand column, paragraph 2 ----- -/--	1

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
- "E" earlier application or patent 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
- "&" document member of the same patent family

Date of the actual completion of the international search 21 January 2015	Date of mailing of the international search report 28/04/2015
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Meyer, Matthias

INTERNATIONAL SEARCH REPORT

International application No

PCT/CH2014/000012

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>Y W KWON AND S HOSOGLU: "Application of lattice Boltzmann method, finite element method, and cellular automata and their coupling to wave propagation problems", COMPUTERS AND STRUCTURES, PERGAMON PRESS, GB, vol. 86, no. 7-8, 12 March 2008 (2008-03-12), pages 663-670, XP022523736, ISSN: 0045-7949, DOI: 10.1016/J.COMPSTRUC.2007.07.013 abstract page 664, left-hand column, paragraph 2 - page 664, right-hand column, paragraph 3 figure 1</p>	1-9
A	<p>----- Y GUANGWU: "A Lattice Boltzmann Equation for Waves", JOURNAL OF COMPUTATIONAL PHYSICS, vol. 161, no. 1, 1 June 2000 (2000-06-01), pages 61-69, XP055163530, ISSN: 0021-9991, DOI: 10.1006/jcph.2000.6486 the whole document -----</p>	1-9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CH2014/000012

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

Method for representing the propagation of waves in a medium

2. claims: 10-20

Method for geophysical depth migration

3. claims: 21-31

Method for determining an Earth property model
