

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
7 April 2005 (07.04.2005)

PCT

(10) International Publication Number
WO 2005/031502 A3

- (51) International Patent Classification:
G06F 11/30 (2006.01) G06F 15/00 (2006.01)
- (21) International Application Number:
PCT/US2004/030268
- (22) International Filing Date:
16 September 2004 (16.09.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/505,120 22 September 2003 (22.09.2003) US
- (71) Applicant and
(72) Inventor: HYEUNG-Yun, Kim [KR/US]; 3351 Alma Street #305, Palo Alto, CA 94306 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, 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, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (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, IT, LU, MC, 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).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

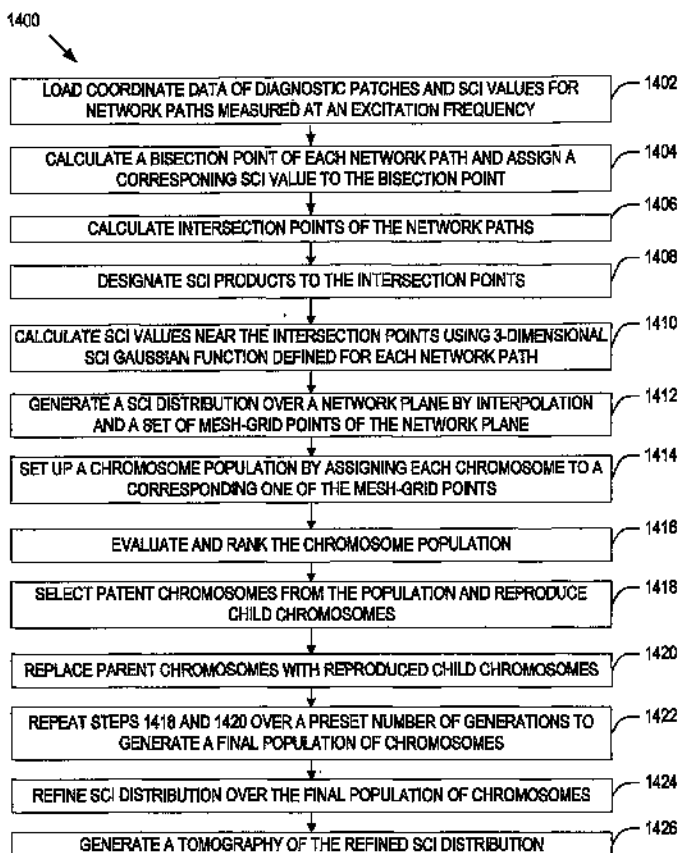
Published:

- with international search report
- with amended claims

- (88) Date of publication of the international search report:
29 March 2007

[Continued on next page]

(54) Title: METHODS FOR MONITORING STRUCTURAL HEALTH CONDITIONS



(57) Abstract: The present invention provides methods for interrogating a damage of a host structure using a diagnostic network patch (DNP) system having patches. An interrogation module partitions the plurality of patched in subgroups and measures the sensor signals generated and received by actuator and sensor patches, respectively. Then, a process module loads sensor signal data to identify Lamb wave modes, determine the time of arrival of the modes and generate a tomographic image. It also determines distribution of other structural condition indices to generate tomographic images of the host structure. A set of tomographic images can be stacked to generate a hyperspectral tomography cube. A classification module generates codebook based on K-mean/Leaming Vector Quantization algorithm and uses a neural-fuzzy-inference system to determine the type of damages of the host structure.

WO 2005/031502 A3

AMENDED CLAIMS
received by the International Bureau on 19 February 2007

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1-41. (canceled)

42. (New) A computer-implemented method for interrogating health conditions of a structure by using a plurality of diagnostic network patches (DNP) implemented thereto, each of the patches being able to operate as at least one of a transmitter patch and a sensor patch, the method comprising:

forming a diagnostic network including the patches and a plurality of signal transmission paths, each said signal transmission path being a signal link between a transmitter patch and a sensor patch;

representing the diagnostic network by a graph, wherein the patches and signal transmission paths are respectively abstracted as nodes and edges in the graph;

partitioning the diagnostic network into one or more subgroups, each of the subgroups including a designated transmitter patch and one or more sensor patches;

causing, by use of a computer processor, the designated transmitter patch to transmit a signal and the sensor patches to receive the signal; and

comparing the received signal with a baseline signal to determine a deviation therebetween, the baseline signal being measured by use of the diagnostic network in absence of structural anomaly; and

analyzing the deviation to determine the health conditions of the structure.

43. (New) The method of claim 42, further comprising:
storing the received signal and the deviation in a depository.

44. (New) The method of claim 42, wherein the step of analyzing includes:
performing a diagnostic data processing;