Claim No: HP-2022-000012

IN THE HIGH COURT OF JUSTICE
BUSINESS AND PROPERTY COURTS OF ENGLAND & WALES
INTELLECTUAL PROPERTY LIST (ChD)
PATENTS COURT

B E T W E E N :

(1) SCIENTIFIC DRILLING CONTROLS LIMITED

(2) SCIENTIFIC DRILLING INTERNATIONAL, INC.
(a company incorporated under the laws of the State of Texas)

Claimants

- and -

(1) GYRODATA INCORPORATED
(a company incorporated under the laws of the State of Texas)

(2) SCHLUMBERGER TECHNOLOGY B.V.
(a company incorporated under the laws of the Netherlands)

Defendants

ANNEX A

~~1. A method for providing information regarding the tortuosity of a wellbore path, the method comprising:~~

~~receiving data from a plurality of survey stations of a wellbore survey; and~~

~~determining a plurality of tortuosity parameter values for the wellbore path within a corresponding plurality of analysis windows, wherein each analysis window has at least one tortuosity parameter value.~~

~~2. The method of Claim 1, wherein the data include information regarding a position of the wellbore path at each survey station of the plurality of survey stations.~~

~~3. The method of any preceding claim, wherein the data include information regarding the north, east, and vertical coordinates of the wellbore path at each survey station of the plurality of survey station.~~

~~4. The method of any preceding claim, wherein the data were previously generated during a wellbore survey with a spacing between sequential survey stations of less than 30 meters, less than 10 meters, less than 1 meter, less than 0.5 meter, less than 0.3 meter, or less than 0.1 meter.~~

~~5. The method of any preceding claim, wherein receiving the data comprises generating the data by running a wellbore survey tool within the wellbore.~~

~~6. The method of any preceding claim, wherein each analysis window denotes a corresponding portion of the data.~~

~~7. The method of any preceding claim, wherein determining the plurality of tortuosity parameter values comprises calculating the at least one tortuosity parameter value based on two or more survey stations within an analysis window.~~

~~8. The method of any of Claims 1 to 7, wherein the at least one tortuosity parameter value of a corresponding analysis window comprises a tortuosity parameter value that is equal to T = S/L - 1 , wherein S is a distance along the wellbore path or along a smoothed version of the wellbore path between two survey stations of the corresponding analysis window and L is a distance in a straight line or along a smoothed version of the wellbore path between the two survey stations, wherein the smoothing, if applied, is defined such that S>=L.~~

~~9. The method of any of Claims 1 to 7, wherein the at least one tortuosity parameter value of a corresponding analysis window comprises a tortuosity parameter value that is a function of S/L, wherein S is a distance along the wellbore path or along a smoothed version of the wellbore path between two survey stations of the corresponding analysis window and L is a distance in a straight line or along a smoothed version of the wellbore path between the two survey stations, wherein the smoothing, if applied, is defined such that S>=L.~~

1~~0~~. A method for providing information regarding the tortuosity of a wellbore path, the method comprising:

receiving data from a plurality of survey stations of a wellbore survey; and

determining a plurality of tortuosity parameter values for the wellbore path within a corresponding plurality of analysis windows, wherein each analysis window has at least one tortuosity parameter value

~~The method of any of Claims 1 to 7~~, wherein the at least one tortuosity parameter value of a corresponding analysis window comprises a tortuosity parameter value that is based on an effective inner diameter (Deff) for the analysis window defined as a maximum width of an outer periphery of a model device with a specified length that can be placed at, or passed through, a portion of the wellbore defined by the analysis window.

2~~11~~. The method of Claim 1~~0~~, wherein Deff for the analysis window is defined as the maximum allowed outer diameter of a model straight tubular device with a specified length that can be placed at, or passed through, the portion of the wellbore defined by the analysis window.

3~~12.~~ The method of Claim 1~~0~~, wherein whether the model device can be placed at, or passed through, the portion of the wellbore defined by the analysis window is determined

based on the amount of transversal forces (F) that the model device would experience while the model device is within the portion of the wellbore, the amount of transversal moment (M) that the model device would experience while the model device is within the portion of the wellbore, or both.

413. The method of Claim 10, wherein Deff for the analysis window is defined as the maximum allowed outer diameter of a model tubular device that can be placed at, or passed through, the portion of the wellbore defined by the analysis window with a specified length and configured to withstand a specified amount of bending.

514. A method for providing information regarding the tortuosity of a wellbore path, the method comprising:

receiving data from a plurality of survey stations of a wellbore survey; and

determining a plurality of tortuosity parameter values for the wellbore path within a corresponding plurality of analysis windows, wherein each analysis window has at least one tortuosity parameter value

The method of any of Claims 1 to 7, wherein the at least one tortuosity parameter value of a corresponding analysis window comprises a tortuosity parameter value that is based on a maximum device length (Lmax) defined as the maximum allowed length of a model tubular device that can be placed at, or passed through, a portion of the wellbore defined by the analysis window with a specified outer diameter.

615. The method of any preceding claim, further comprising separating the tortuosity parameter value of a corresponding analysis window into two or more contributions in two or more corresponding length scales.

716. The method of Claim 615, wherein said contributions are derived by low-pass or high-pass spatial filtering applied to one or more of inclination, azimuth, north, east, and vertical parameters as a function of measured depth.

817. The method of any preceding claim, further comprising displaying at least some of the plurality of tortuosity parameter values.

918. The method of Claim 817, further comprising selecting, using at least some of the displayed plurality of tortuosity parameter values, a position within the wellbore to place a device.

1019. The method of Claim 918, further comprising placing the device at the position.

1120. The method of Claim 918, wherein the device comprises a pump or a rod guide.

1221. A computer system for providing information regarding the tortuosity of a wellbore path, the computer system comprising:

a memory; and

a processor configured to:

receive data from a plurality of survey stations of a wellbore survey; and

determine a plurality of tortuosity parameter values for the wellbore path within a corresponding plurality of analysis windows, wherein each analysis window has at least one tortuosity parameter value.

13~~22~~. A tangible computer-readable medium having instructions stored thereon which instruct a computer system to provide information regarding the tortuosity of a wellbore path by at least:

receiving data from a plurality of survey stations of a wellbore survey; and

determining a plurality of tortuosity parameter values for the wellbore path within a corresponding plurality of analysis windows, wherein each analysis window has at least one tortuosity parameter value.

14~~23~~. The method of any of Claims 1-11~~20~~, further comprising performing one or more spectral analyses within a plurality of portions of the data.

15~~24~~. The method of Claim 14~~23~~, wherein the one or more spectral analyses include calculating a Fourier transform of the data to generate a spatial frequency relative to one or more coordinates of the wellbore path as a function of the measured depth of the wellbore path.

16~~25~~. The method of Claim 14~~23~~, wherein the one or more spectral analyses include calculating a spectral transform of the data to generate a spatial frequency relative to at least one or more coordinates of the wellbore path as a function of the measured depth of the wellbore path.