# CLAIMS

What is claimed is:

1. A sensor system for a downhole pumping system, comprising:

a sensor subsystem for detecting movement of at least one component of the downhole pumping system, the sensor subsystem comprising:

an axial motion sensor subsystem comprising a magnetometer, the magnetometer to be coupled to the at least one component of the downhole pumping system and to detect axial movement of the at least one component of the downhole pumping system based on variations in a magnet field detected by the magnetometer generated by movement of the at least one component of the downhole pumping system; and

a rotation sensor subsystem comprising a gyroscope, the gyroscope to be coupled to the at least one component of the downhole pumping system and to detect rotational movement of the at least one component of the downhole pumping system by detecting rotational velocity values with the gyroscope generated by rotation of the at least one component of the downhole pumping system; and

a processor subsystem to receive data from the axial motion sensor subsystem and the rotation sensor subsystem, the processor subsystem to:

determine axial movement of the at least one component of the downhole pumping system with the axial motion sensor subsystem; and

determine rotational velocity of the at least one component of the downhole pumping system with the rotation sensor subsystem by sampling rotational velocity values generated by the rotation of the at least one component of the downhole pumping system with the gyroscope.

2. The sensor system of claim 1, wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system comprising at least one rod of the downhole pumping system extending from a surface location into a wellbore.

3. The sensor system of claim 2, wherein the processor subsystem is configured to verify the axial movement of the at least one rod before determining the rotation.

4. The sensor system of claim 2, wherein the processor subsystem is configured to determine a change in direction the at least one rod.

5. The sensor system of claim 4, wherein the processor subsystem is configured to begin sampling the rotational velocity after determining the change in direction the at least one rod.

6. The sensor system of claim 5, wherein the processor subsystem is configured to continue sampling the rotational velocity until another change in direction the at least one rod is detected.

7. The sensor system of claim 5, wherein the processor subsystem is configured to continue sampling the rotational velocity along substantially an entire stroke of the at least one rod, the sampling beginning at a first change of direction of the at least one rod, continuing through a second change of direction of the at least one rod, and ceasing at a third change of direction of the at least one rod.

8. The sensor system of claim 1, wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system comprising a tubing rotator of the downhole pumping system.

9. The sensor system of claim 8, wherein the sensor subsystem is configured to detect rotation of the tubing rotator while detecting axial movement of a polished of the downhole pumping system.

10. The sensor system of claim 1, wherein the processor subsystem is configured to determine the rotational velocity of the at least one component of the downhole pumping system

by summing both positive and negative samples of the rotational velocity values sensed by the rotation sensor subsystem.

11. The sensor system of claim 10, wherein the processor subsystem is configured to compare the determined rotational velocity of the at least one component of the downhole pumping system with an expected amount of rotational velocity to determine a failure in the rotation of the at least one component of the downhole pumping system.

12. The sensor system of claim 1, further comprising a vibration sensor subsystem for monitoring vibration of the at least one component of the downhole pumping system over a vibrational baseline.

13. A sensor system for a downhole pumping system, comprising:

a sensor subsystem for detecting movement of at least one component of the downhole pumping system, the sensor subsystem comprising:

an axial motion sensor subsystem comprising an axial motion sensor, the axial motion sensor to be coupled to the at least one component of the downhole pumping system and to detect axial movement of the at least one component of the downhole pumping system based on variations detected by the axial motion sensor generated by movement of the at least one component of the downhole pumping system; and

a rotation sensor subsystem comprising a rotational sensor, the rotational sensor to be coupled to the at least one component of the downhole pumping system and to detect rotational movement of the at least one component of the downhole pumping system by sampling rotational velocity values with the rotational sensor generated by rotation of the at least one component of the downhole pumping system; and

a processor subsystem to receive data from the axial motion sensor subsystem and the rotation sensor subsystem, the processor subsystem to:

verify the axial movement of the at least one component of the downhole pumping system with the axial motion sensor subsystem; and

when the axial movement has been verified, determine rotational velocity of the at least one component of the downhole pumping system with the rotational velocity values detected by the rotation sensor subsystem.

14. The sensor system of claim 13, wherein the axial motion sensor subsystem comprises a magnetometer and the rotation sensor subsystem comprises a gyroscope.

15. The sensor system of claim 14, wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system comprising at least one rod of the downhole pumping system extending from a surface location into a wellbore, and wherein the processor subsystem is configured to continue sampling the rotational velocity values of the at least one rod over a stroke of the at least one rod.

16. A sensor system for a downhole pumping system, comprising:

a sensor subsystem for detecting movement of a tubing rotator of the downhole pumping system, the sensor subsystem comprising a rotation sensor subsystem comprising a rotational sensor, the rotational sensor to be coupled to the tubing rotator of the downhole pumping system and to detect rotational movement of the tubing rotator of the downhole pumping system by sampling rotational velocity values with the rotational sensor generated by rotation of the tubing rotator of the downhole pumping system; and

a processor subsystem to receive data from the rotation sensor subsystem, the processor subsystem to determine rotational velocity of the tubing rotator of the downhole pumping system with the rotational velocity values detected by the rotation sensor subsystem.

17. The sensor system of claim 16, wherein the rotation sensor subsystem comprises at least one of a gyroscope or an accelerometer.

18. The sensor system of claim 16, wherein the rotation sensor subsystem is configured to monitor the rotation of the tubing rotator along a path that extends in a direction substantially perpendicular to a surface upon which the downhole pumping system is positioned.

19. A method of detecting motion of at least one component of a downhole pumping system, the method comprising:

detecting axial movement of at least one component of the downhole pumping system based on variations detected by an axial motion sensor coupled to the at least one component of the downhole pumping system generated by translation of the at least one component of the downhole pumping system;

detecting rotational movement of the at least one component of the downhole pumping system with a rotational sensor generated by rotation of the at least one component of the downhole pumping system; and

verifying axial movement of the at least one component of the downhole pumping system with the axial motion sensor before the detecting of the rotational movement of the at least one component of the downhole pumping system with the rotational sensor.

20. The method of claim 19, further comprising comparing a rotational velocity detected with the rotational sensor with a threshold value to determine a performance characteristic of the at least one component of the downhole pumping system.