CLAIMS

1. An apparatus for detecting deterioration of a rotating part, comprising
    - a metal case (1) having a slot (1.1) to which an acoustic emission (AE) sensor (2) is mounted; and
    - a waveguide rod (3) having a proximal end (3.1) connected with the AE sensor (2) in an abutting relation and a distal end (3.2) ~~mounted~~ mountable to the rotating part,

    wherein the waveguide rod (3) has a length ranging from ~~of at least~~ 50-320 mm.
2. The apparatus according to claim 1, wherein the waveguide rod (3) has a length ranging from 100-320 mm, preferably 100-200 mm, and more preferably 140-160 mm.
3. The apparatus according to claim 1, wherein the metal case (1) is configured to comprise a hollow body (1.2) having a plurality of fins (1.2.1) extending from an inner wall of the hollow body (1.2) to a wall of the slot (1.1), and a hole (1.2.2) through which the waveguide rod (3) is passed.
4. The apparatus according to claim 3, wherein the hollow body (1.2) has a rectangular or semi-circular shape, and the plurality of fins (1.2.1) are spaced apart from each other along a radial line of the hollow body (1.2).
5. The apparatus according to claim 1, wherein the slot (1.1) is shaped to correspond with the shape of the AE sensor (2) and comprises a fastening means (1.1.1) for securely mounting the AE sensor (2) inside the slot (1.1).
6. The apparatus according to claim 5, wherein the fastening means (1.1.1) are two sets of screw ending with pad for mounting with two opposite sides of the AE sensor (2).
7. The apparatus according to any one of claims 1-6, wherein the metal case (1) is made of a material having a thermal conductivity ranging from 50 to 300 W/m.K, preferably from 100 to 200 W/m.K, and more preferably from 100 to 150 W/m.K.
8. The apparatus according to claim 7 wherein the metal case (1) is made of brass, steel or aluminum.

9. The apparatus according to claim 1 or 2 wherein the waveguide rod (3) is a cylindrical rod with a diameter of at least 5 mm.

10. The apparatus according to claim 9 wherein the waveguide rod (3) has a diameter ranging from 5 to 15 mm, preferably from 6 to 12 mm, and more preferably from 6 to 10 mm.

11. The apparatus according to any one of claims 1-2 or 9-10, wherein the waveguide rod (3) is made of a material having a transmission coefficient ranging from 0.4 to 0.7, preferably 0.5 to 0.6.

12. The apparatus according to claim 11, wherein the waveguide rod (3) is made of brass, steel or aluminum.

13. The apparatus according to any one of claims 1-12, wherein the waveguide rod (3) is connected to the AE sensor (2) by means of a flange (4) provided at the proximal end (3.1) of the waveguide rod (3) and a spring (5) provided in a compressed manner between the flange (4) and the hole (1.2.2) of the hollow body (1.2).

14. The apparatus according to any one of claims 1-13 further comprises a mounting means (6) provided at the distal end (3.2) of the waveguide rod (3) to facilitate mounting of the waveguide rod (3) to the rotating part.

15. The apparatus according to claim 14, wherein the mounting means (6) is a magnetic adaptor, thread or adhesive.

16. The apparatus according to any one of claims 1-15 further comprises a processing unit (7) being in communication with the AE sensor (2) for receiving acoustic emission data from the AE sensor (2) and determining deterioration of the rotating part.

17. A method for detecting deterioration of the rotating part, comprising steps of:

    a) obtaining the acoustic emission data using the apparatus according to any one of claims 1-16; and

    b) processing the acoustic emission data obtained from step a) to determine deterioration of the rotating part

wherein the step b) comprises extracting at least one of predetermined frequencies from all frequencies and calculating a Kurtosis value (K) of the rotating part for said predetermined frequencies using the following equation:

$$K = \frac{\frac{\sum_{i=1}^{N} (X_i - \bar{X})^4}{N}}{S^4}$$

wherein

K represents a Kurtosis value of the rotating part

X represents an amplitude of the acoustic emission data

S represents a standard deviation value of the amplitude of the acoustic emission data, and

N represents number of the acoustic emission data used in calculating.

18. The method according to claim 17, wherein the step of extracting at least one of predetermined frequencies from all frequencies is conducted by a wavelet decomposition method.

19. The method according to claim 17 further comprises a step of c) defining an operation state of the rotating part based on the Kurtosis value (K) of the rotating part.

20. The method according to claim 19, wherein the operation state of the rotating part is classified into a normal state, a monitor state, an alarm state and a maintenance state based on the following Kurtosis value (K):

the normal state when $K<3$;

the monitor state when $3 \leq K<5$;

the alarm state when $5 \leq K<10$; and

the maintenance state when $K \geq 10$.

21. The method according to claim 19 or 20 further comprises a step of d) sending information regarding the operation state of the rotating part to a user's electronic device.