

Claims

[Claim 1] A method for managing maintenance for a ship (1) including at least one sealed and thermally insulating tank for transporting liquefied gas, the tank having a geometry and a position on the ship, the method comprises the steps consisting in:

- determining (310) a current filling level of the tank,
- determining (320) a current state of movement of the ship,
- determining (330) a current sloshing index I_{Bi} from the current filling level of the tank and the current state of movement of the ship, taking into account the position and the geometry of the tank, wherein the current sloshing index (I_{Bi}) is obtained by reading a value in a multiple entry correspondence table, an entry corresponding to the filling of the tank, at least one entry corresponding to the current state of movement of the ship and the read value representing a probability of deterioration of the tank when it is subjected to the current state of movement of the ship,
- integrating (340) the determined current sloshing index I_{Bi} into a wear index I_{Ui} that takes into account a history of the sloshing indices,
- comparing (430, 450) the wear index to a first threshold in order to indicate if the tank (440, 460) needs to be inspected, depending on the result of the comparison.

[Claim 2] The method as claimed in claim 1, in which the ship includes a plurality of tanks (3, 4, 5, 6), in which a wear index (I_{Ui}) is determined for each tank and in which the first threshold corresponds to a wear index (I_{Ui}) of another tank in order to indicate (460) that an inspection of the tank that has the highest wear index (Max(I_{Ui})) must be carried out.

[Claim 3] The method as claimed in claim 1 or 2, in which an inspection of the indicated tank is carried out.

[Claim 4] The method as claimed in claims 2 and 3, in which, after inspection of the tank corresponding to the highest wear index (Max(I_{Ui})), and if that inspected tank is damaged then there is determined (480) the next tank that must be inspected as being the tank having the highest wear index of the remaining tanks.

[Claim 5] The method as claimed in claims 2 and 3, in which, after inspection of a tank, and if that tank is not damaged, then the inspection of the tanks is halted.

[Claim 6] The method as claimed in any one of the preceding claims, in which the comparison (450) of the wear index (I_{Ui}) to a threshold is carried out during a maintenance operation on the ship.

[Claim 7] The method as claimed in any one of the preceding claims, in which determining a current state of movement of the ship includes determining at least one of the following parameters:

- height of the waves,

- period of the waves,
- angle of attack of the waves relative to the orientation of the ship,
- speed of the ship,
- vibrations of the ship,
- measured movements of the ship.

[Claim 8] The method as claimed in any one of the preceding claims, in which determining a current sloshing index (IBi) takes into account at least one of the following additional structure state parameters:

- number of thermal cycles to which the tank has been subjected,
- elongation of the ship,
- level of stiffness of the hull,
- nature of the liquefied gas,
- level of filling of the ballast tanks.

~~[Claim 9] The method as claimed in any one of the preceding claims, in which determining the current sloshing index (IBi) consists in determining a probability of deterioration of the tank when it is subjected to the current state of movement of the ship.~~

~~[Claim 10] The method as claimed in any one of the preceding claims, in which the current sloshing index (IBi) is obtained by reading a value in a multiple entry correspondence table, an entry corresponding to the filling of the tank, at least one entry corresponding to the current state of movement of the ship and the read value representing a probability of deterioration of the tank.~~

~~[Claim 11]~~[Claim 9] The method as claimed in any one of the preceding claims, in which integrating the current sloshing index (IBi) corresponds to a summation of current sloshing indices, the current sloshing indices being calculated successively during successive measurement periods.

~~[Claim 12]~~[Claim 10] A system for managing maintenance (100, 200) for a ship including at least one sealed and thermally insulating tank for transporting liquefied gas, the system including:

- at least one tank filling level sensor (121, 230) for measuring a current level of filling of the at least one tank,
- a device for evaluating movements of the ship (122, 123, 130, 230) able to determine a current state of movement of the ship,
- a processing means (110, 210) configured:
 - to determine (330) a current sloshing index (IBi) from the current level of filling of the tank and the current state of movement of the ship, taking into account the position

and the geometry of the tank, wherein the current sloshing index (IBi) is obtained by reading a value in a multiple entry correspondence table, an entry corresponding to the filling of the tank, at least one entry corresponding to the current state of movement of the ship and the read value representing a probability of deterioration of the tank when it is subjected to the current state of movement of the ship,

- integrating (340) the current sloshing index (IBi) determined into a wear index (IUi) that takes into account a history of the sloshing indices,
- comparing (430, 450) the wear index to a first threshold,
- a warning device (41) indicating if an inspection of the at least one tank must be carried out (440, 460) as a function of the result of the comparison.

~~[Claim 13]~~[Claim 11] The system as claimed in claim ~~12~~10 in which the device for evaluating movements of the ship (123) includes a weather station that measures the height, the frequency and the direction of the waves in the environment of the ship.

~~[Claim 14]~~[Claim 12] The system as claimed in claim ~~12 or 13~~10 or 11, in which the processing means is in part located in a monitoring station (200) on land and communicated by radio to the ship to receive information relating to the current level of filling of the at least one tank and the current state of movement of the ship.

~~[Claim 15]~~[Claim 13] A ship for transporting liquefied gas including a plurality of sealed and thermally insulating tanks, the ship including a management system (100) as claimed in any one of claims ~~12 to 14~~10 to 12 for each of its tanks.