CLAIMS

1. Road vehicle (3) including front wheels (11) mounted on a steering front axle (4) and rear wheels (9) mounted on a rear axle (5), characterized in that it includes an assistance system (1) for berthing maneuvers at a pier (2) and in that the rear axle (5) is steering and equipped with a steering (7), wherein the assistance system (1) is designed to work according to a road mode or according to a berthing mode, and including the following means:

- a directional steering system (10) designed to control the steering angle A_{AR} of the rear wheels (9);
- a distance sensor (16) provided at the back of the vehicle (3) to measure a distance D_{ARpier} from the back of the vehicle (3) to the pier (2);

wherein:

- in the road mode, either the rear wheels (9) are straight ahead or their steering angle A_{AR} is controlled by the directional steering system (10) based on the steering angle A_{AV} of the front wheels (11);
- in the berthing mode, the steering angle of the rear wheels (9) is controlled by the directional steering system (10) based on the distances measured by the distance sensor (16) and on the steering angle A_{AV} of the front wheels (11),

wherein the assistance system (1) is configured to perform the berthing process including the following steps:

a) a driving phase, where the vehicle (3) drives a classical way, where the assistance system (1) is switched to the road mode, and where the rear wheels (9) are straight ahead or controlled by the front steering;

b) an approach phase, where the vehicle (3) starts berthing to a pier (2), where the assistance system (1)

switches to the berthing mode with the rear wheels (9) remaining to be controlled in the road mode as long as the front distance sensor (15) does not detect the pier (2), and where the rear wheels (9) are controlled by the assistance system (1) as soon as the front distance sensor (15) detects the pier (2), and are steered so that the rear axle (5) is moved to the pier (2);

c) a stop phase, where the vehicle (3) is berthed to the pier (2);

d) a start phase, when the vehicle (3) is leaving the pier (2), where the assistance system (1) switches to the berthing mode and the rear wheels (9) are steered so that the rear axle (5) is moved away from the pier (2);

e) a driving phase, where the vehicle (3) drives a classical way after leaving the pier (2), with the assistance system (1) switched to the road mode and the rear wheels (9) straight ahead or controlled by the front steering,

wherein the "c) stop phase" is the moment when the driver allows the opening of doors, and

wherein the "d) start phase" is the moment when the driver shuts the doors.

2. Road vehicle (3) according to the claim 1, characterized in that the assistance system also includes the following means:

- a distance sensor (15) provided at the front to measure the distance D_{AVpier} from the front of the vehicle (3) to the pier (2);
- a distance sensor (18) provided at the rear of the vehicle (3) to measure the distance D_{ARenv} from the rear of the vehicle (3) to the other obstacles of the environment;

wherein:

- in the road mode, either the rear wheels (9) are straight ahead, or their deflection angle A_{AR} is controlled by the direction driving device (10) based on the deflection angle A_{AV} of the front wheels (11);
- in the berthing mode, the steering angle of the rear wheels (9) is controlled by the direction driving device (10) based on the distances measured by the distance sensors (15, 16, 18).

3. Road vehicle (3) according to any of the previous claims, characterized in that the assistance system also includes a distance sensor (17) provided at the front of the vehicle (3) to measure a distance D_{AVenv} from the front of the vehicle (3) to the other obstacles of the environment.

4. Road vehicle (3) according to any of the previous claims, characterized in that the rear wheels (9) can be steered with an angle, whose absolute value is greater than 10°, preferably more than 20° and more preferably more than 30°.

5. Road vehicle (3) according to any of the previous claims, characterized in that, in the road mode, the direction driving device (10) monitors the deflection angle A_{AR} of the rear wheels (9) so that the rear wheels (9) are initially straight ahead, then, beyond a given value of the steering angle of the front wheels (11), the deflection of the rear wheels (9) is controlled as a proportional and linear function of the steering command from the front wheels (11).

6. Road vehicle (3) according to any of the previous claims, characterized in that, in the road mode, the rear axle (5) is fixed with straight ahead rear wheels (9) when the speed of the

vehicle (3) is faster than the maximum speed in the road mode S_{VAR}.

7. Road vehicle (3) according to any of the previous claims, characterized in that the assistance system (1) automatically switches from the berthing mode to the road mode when the speed of the vehicle is faster than the maximum berthing speed $V_{MAXberthing}$ or when the deflection angle A_{AV} of the front wheels (11) is more than a value $\alpha_{OutBerthing}$ of the angle out of the pier.

8. Road vehicle (3) according to any of the previous claims, characterized in that the assistance system (1) includes sensors that make it possible to measure the deflection angle A_{AV} of the front wheels (11) and the deflection angle A_{AR} of the rear wheels (9).

9. Road vehicle (3) according to claim 8, characterized in that the front axle (4) includes a steering gear (13), and in that the deflection angle A_{AV} of the front wheels (11) is measured by an angle sensor (12) that is connected to this steering gear (13).

10. Road vehicle (3) according to claim 8, characterized in that the direction driving device (10) includes a mobile rod actuator and in that the deflection angle A_{AR} of the rear wheels (9) is measured by a position sensor (14) connected to the mobile rod actuator of the directional monitoring device (10), while the deflection angle A_{AR} of the rear wheels (9) is calculated based on the position of an actuator rod of the mobile rod actuator.

11. Road vehicle (3) according to claim 1, 2 or 3, characterized in that the distance sensors (15, 16, 17, 18) are positioned on the right side of the vehicle (3).

12. Road vehicle (3) according to claim 1, 2 or 3, characterized in that the distance sensors (15, 17) provided at the front of the vehicle (3) are positioned in front of the front wheels (11), in

that the distance sensor to the pier (16) provided at the rear of the vehicle (3) is positioned in front of the rear wheels (9) and in that the distance sensor to the environment (18) is positioned behind the rear wheels (9).

13. Road vehicle (3) according to claim 1, 2 or 3, characterized in that the distance information from the front and the rear that are received by the distance sensors (15, 16, 17, 18) are visually transmitted to the driver.

14. Road vehicle (3) according to any of the previous claims, characterized in that the assistance system (1) includes a berthing/road mode switch (20) that makes the assistance system (1) change between the road mode and the berthing mode when triggered.

15. Road vehicle (3) according to the previous claims, characterized in that the berthing/road mode switch (20) is manually activated by the driver thanks to a button (21) provided inside a driver’s cab of the vehicle (3) or is activated through a dialog without contact between an infrastructure and the vehicle (3).

16. Road vehicle (3) according to the claim 14, characterized in that the berthing/road mode switch (20) does not allow the driver to change the assistance system (1) from the road mode to the berthing mode as long as the vehicle (3) drives faster than the maximum berthing speed $V_{MAXberthing}$.

17. Road vehicle (3) according to any of the previous claims, characterized in that the assistance system (1) also includes an onboard intelligence (22) that monitors the directional steering device (10) to the rear axle (5).

18. Road vehicle (3) according to the claims 8, 14, and 17,

characterized in that the onboard intelligence (22) is connected to the distance sensors (15, 16, 18), to the sensors that measure the deflection angle A_{AV} of the front wheels (11) and the deflection angle A_{AR} of the rear wheels (9), and to the berthing/road mode switch (20).

19. Road vehicle (3) according to the claim 18, characterized in that the onboard intelligence (22) includes a memory to store the mathematical formulas as used in the assistance system (1) to monitor the deflection angle of the rear wheels (9) in the road mode and the berthing mode, and the constant values as used with these formulas.

20. Berthing process to a pier for a road vehicle (3) according to any of the previous claims, characterized in that, in the stop phase, the rear wheels (9) are controlled to go back to a non-steered position.