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### CONTROL DEVICE FOR VEHICLE

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#### Abstract

A control device, for a vehicle, include a determination unit configured to determine whether or not a traveling mode of the vehicle equipped with an engine as a traveling power source is switched to a circuit mode, and a switching unit configured to switch a target idle speed to a higher speed when the determination unit makes an affirmative determination than when the determination unit makes a negative determination.

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## Background/Summary

### CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon and claims the benefit of priority of the prior Japanese Patent Application No. 2024-019707, filed on Feb. 13, 2024, the entire contents of which are incorporated herein by reference.

### TECHNICAL FIELD

[0002] The present disclosure relates to a control device for a vehicle.

### BACKGROUND

[0003] There is a vehicle that switches a traveling mode to a circuit mode (see, for example, Japanese Unexamined Patent Application Publication No. 2015-199382).

[0004] When the traveling mode is switched to the circuit mode, it is desirable to have a performance property to show the difference between the other modes and the circuit mode.

### SUMMARY

[0005] It is therefore an object of the present disclosure to provide a control device for a vehicle that improves performance of a circuit mode.

[0006] The above object is achieved by a control device for a vehicle, including: a determination unit configured to determine whether or not a traveling mode of the vehicle equipped with an engine as a traveling power source is switched to a circuit mode; and a switching unit configured to switch a target idle speed to a higher speed when the determination unit makes an affirmative determination than when the determination unit makes a negative determination, the target idle speed being a target value of speed of the engine in an idle operation state.

[0007] When an automatic transmission of the vehicle is in any one of a D range and an R range, the switching unit may be configured to switch the target idle speed to a lower speed than when the automatic transmission is in any one of an N range and a P range, and the switching unit may be configured to switch the target idle speed to a lower speed when the automatic transmission is in the R range than when the automatic transmission is in the D range.

[0008] The control device may further include a gradual change process unit configured to control the engine so as to gradually change the speed of the engine toward the target idle speed, when the target idle speed is switched by the switching unit.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a schematic configuration view of a vehicle;

[0010] FIG. 2 is a flowchart illustrating an example of performance control; and

[0011] FIG. 3 is a timing chart illustrating a transition of an engine speed by the performance control.

### DETAILED DESCRIPTION

#### Schematic Configuration of Vehicle

[0012] FIG. 1 is a schematic view illustrating a schematic configuration of a vehicle 1. The vehicle 1 includes an engine (ENG) 10, a torque converter (T/C) 12, and a stepped automatic transmission (A/T) 14. The engine 10 is a gasoline engine, but may be a diesel engine. The torque converter 12 is connected to a crankshaft 11 of the engine 10. A turbine shaft 13 of the torque converter 12 is connected to an input side of the automatic transmission 14, and the driving force of the engine 10 is transmitted to the automatic transmission 14. An output shaft 15 of the automatic transmission 14 is connected to a differential gear 16 that is a final reduction gear. The differential gear 16 is connected to left and right shafts 17. The driving force transmitted to the output shaft 15 is

transmitted to driving wheels **18** via the shafts **17**.

[0013] The automatic transmission **14** is a stepped transmission and includes a plurality of hydraulic friction engagement elements and a planetary gear device. In the automatic transmission **14**, the automatic transmission **14** is switched to any one of a P (parking) range, an R (reverse) range, an N (neutral) range, and a D (drive) range by selectively engaging a plurality of friction engagement elements.

[0014] An Electronic Control Unit (ECU) **20** performs control processing related to the vehicle **1**. The ECU **20** is a computer including a central processing unit (CPU), a random access memory (RAM), and a read only memory (ROM). The ECU **20** is an example of a control device of the car, and functionally achieves a determination unit, a switching unit, and a gradual change process unit, which will be described in detail later.

[0015] A crank angle sensor **21**, a shift position sensor **22**, an air flow meter **23**, an accelerator opening sensor **24**, a mode changeover switch **25**, and a vehicle speed sensor **26** are connected to the ECU **20**. Outputs from these sensors are input to the ECU **20**. The crank angle sensor **21** detects the speed of the engine **10**. The shift position sensor **22** detects whether the shift lever is in a P range position, an R range position, an N range position, or a D range position. The air flow meter **23** detects an intake air amount of the engine **10**. The accelerator opening sensor **24** detects an accelerator opening degree that is an opening degree of an accelerator pedal. The mode changeover switch **25** switches a traveling mode to be described later. The vehicle speed sensor **26** detects a traveling speed of the vehicle **1**.

[0016] The ECU **20** calculates a required torque and a target speed of the engine **10** based on the speed, the intake air amount of the engine **10**, and the accelerator opening degree detected by the above-described sensors. The ECU **20** controls a fuel injection amount, an intake air amount, and an ignition timing in the engine **10** based on the required torque and the target speed. For example, when the engine **10** is in an idle operation state, the ECU **20** controls the fuel injection amount, the intake air amount, and the ignition timing so that the speed of the engine **10** becomes a target idle speed.

[0017] The ECU **20** can switch the traveling mode to any one of a normal mode, a sport mode, an eco mode, and a circuit mode. A driver switches the traveling mode to the normal mode, the sport mode, or the eco mode by operating the mode changeover switch **25**. Regarding the circuit mode, for example, when the vehicle **1** is in a circuit site, the driver can operate a mobile terminal such as a smartphone to switch the traveling mode to the circuit mode. When the traveling mode is switched to the circuit mode, the control map of the vehicle **1** is switched to a control map in which priority is given to the traveling performance corresponding to the circuit mode. This improves the traveling performance of the vehicle **1** as compared with the traveling modes other than the circuit mode. The switching to the circuit mode may be performed by the mode changeover switch **25** as described above.

#### Performance Control

[0018] FIG. **2** is a flowchart illustrating an example of performance control. This control is continuously repeated while the ignition is on. The ECU **20** determines whether the traveling mode is switched to the circuit mode or not (step **S1**). Step **S1** is an example of a process executed by the determination unit.

[0019] If the determination result is No in step **S1**, the ECU **20** sets the target idle speed to a speed **A1** (step **S2**). The speed **A1** is a value lower than any of speeds **A2** to **A4** described later.

[0020] If the determination result is Yes in step **S1**, the ECU **20** determines whether the automatic transmission **14** is in any of the N range and the P range (step **S3**). If the determination result is Yes in step **S3**, the ECU **20** switches the target idle speed to the speed **A4** (step **S4**). The speed **A4** is a value higher than any of the speeds **A1** to **A3**. Therefore, when the traveling mode is switched to the circuit mode, the driver notices that the idle speed of the engine **10** increases and easily recognizes the difference between the other traveling modes and the circuit mode. Thus, the

performance of the circuit mode is improved. Step S4 is an example of a process executed by the switching unit.

[0021] If the determination result is No in step S3, the ECU 20 determines whether the automatic transmission 14 is in the D range or not (step S5). If the determination result is Yes in step S5, the ECU 20 switches the target idle speed to the speed A3 (step S6). The speed A3 is lower than the speed A4, higher than the speed A1, and higher than the speed A2. This prevents the vehicle speed from becoming too high during creeping. Since the speed A3 is higher than the speed A1, the performance of the circuit mode is improved also in this case. Step S6 is an example of a process executed by the switching unit.

[0022] If the determination result is No in step S5, the automatic transmission 14 is regarded as being in the R range, and the ECU 20 switches the target idle speed to the speed A2 (step S7). The speed A2 is lower than the speed A3, lower than the speed A4, and higher than the speed A1. This also prevents the vehicle speed from becoming too high during creep driving in reverse. Since the speed A2 is higher than the speed A1, the performance of the circuit mode is improved also in this case. Step S7 is an example of a process executed by the switching unit.

[0023] Next, the ECU 20 determines whether or not the target idle speed is switched, due to a change in the shift position or a switch in the traveling mode (step S8). If the determination result is No in step S8, the control ends. If the determination result is Yes in step S8, the ECU 20 performs the gradual change process (step S9). The gradual change process is a process of gradually changing the engine speed toward the switched target idle speed. Concretely, the ECU 20 gradually changes the fuel injection amount and the intake air amount toward the fuel injection amount and the intake air amount corresponding to the switched target idle speed. Thus, the engine speed is gradually changed toward the switched target idle speed. Step S9 is an example of a process executed by the gradual change process unit.

[0024] FIG. 3 is a timing chart illustrating a transition of the engine speed in the performance control. When the automatic transmission 14 is in the D range and the traveling mode is switched to the circuit mode, the target idle speed is switched from the speed A1 to the speed A3 (time t1). The engine speed gradually increases from the speed A1 to the speed A3 by the gradual change process described above. When the automatic transmission 14 is switched from the D range to the N range, the target idle speed is switched from the speed A3 to the speed A4 (time t2). Further, the engine speed gradually increases toward the speed A4 by the gradual change process.

[0025] When the automatic transmission 14 is switched from the N range to the R range, the target idle speed is switched from the speed A4 to the speed A2 (time t3). Further, the engine speed is gradually decreased toward the speed A2 by the gradual change process. When the automatic transmission 14 is switched from the R range to the P range, the target idle speed is switched from the speed A2 to the speed A3 (time t4). The engine speed is gradually increased toward the speed A3 by the gradual change process. When the traveling mode is switched to a mode other than the circuit mode, the target idle speed is switched from the speed A3 to the speed A1 (time t5). Further, the engine speed is gradually decreased toward the speed A1 by the gradual change process.

[0026] As described above, the gradual change process prevents the engine speed from rapidly decreasing and the engine 10 from stalling, for example, when the target idle speed is switched to a low speed. Further, when the target idle speed is switched to a high speed, it is possible to avoid the engine speed from rapidly increasing and giving a sense of discomfort to the driver.

[0027] In the embodiment described above, the vehicle 1 including the automatic transmission 14 is described as an example, but the vehicle is not limited thereto. For example, the vehicle may be provided with a manual transmission. In this case, the target idle speed may be switched to a higher target idle speed in the circuit mode than in the mode other than the circuit mode, regardless of the range of the manual transmission. In the above embodiment, the target idle speed is set to be the same between the D range and the P range of the automatic transmission 14, but the present disclosure is not limited to this. For example, the target speed when the automatic transmission 14

is in the D range may be higher than the target idle speed when the automatic transmission **14** is in the P range.

[0028] In the embodiment described above, the vehicle **1** including the engine **10** as a traveling power source has been described as an example, but the vehicle is not limited thereto. For example, the vehicle may be a hybrid vehicle including an engine and a motor as traveling power sources.

[0029] Although some embodiments of the present disclosure have been described in detail, the present disclosure is not limited to the specific embodiments but may be varied or changed within the scope of the present disclosure as claimed.

## Claims

1. A control device for a vehicle, comprising: a determination unit configured to determine whether or not a traveling mode of the vehicle equipped with an engine as a traveling power source is switched to a circuit mode; and a switching unit configured to switch a target idle speed to a higher speed when the determination unit makes an affirmative determination than when the determination unit makes a negative determination, the target idle speed being a target value of speed of the engine in an idle operation state.
  2. The control device for the vehicle according to claim 1, wherein when an automatic transmission of the vehicle is in any one of a D range and an R range, the switching unit is configured to switch the target idle speed to a lower speed than when the automatic transmission is in any one of an N range and a P range, and the switching unit is configured to switch the target idle speed to a lower speed when the automatic transmission is in the R range than when the automatic transmission is in the D range.
  3. The control device for the vehicle according to claim 2, further comprising a gradual change process unit configured to control the engine so as to gradually change the speed of the engine toward the target idle speed, when the target idle speed is switched by the switching unit.
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