**Exercise 7**

Application: This exercise describes an alternative method for estimating the Gear Position signal of a vehicle indirectly via software without using the actual sensor. This alternative method could be useful in case the Gear Position sensor malfunctions or in case the sensor is not easy to install. For this alternative method though, data is required in order to be used as the reference signal.

You have been provided with one .csv file (Lap1) with data from a lap of a racing circuit. Based on the aforementioned data, complete the following tasks:

i) Produce one Figure with two subplots.

Figure 1, Subplot 1: Gear Position ver. 1 for Lap1 (Gear Position - Sensor Signal),

Gear Position vs. Distance (Miles)

Figure 1, Subplot 2: Gear Position ver. 2 for Lap1 (Gear Position - Estimated Signal),

Gear Position vs. Distance (Miles)

Subplot 1 can be implemented via the corresponding column(s) of the .csv file.

Subplot 2 can be implemented via the division of the vehicle’s speed (Corr Speed) by the engine’s speed (Engine Speed RPM); see .csv file. The x-axis should be in Miles.

Each graph should contain, Title, x-axis labeling and y-axis labeling; the units of measurement should also be included.

ii) Step 1: Using Control Flow Matlab statements estimate the Gear Position of the vehicle based on the Gear Position - Estimated Signal displayed in Subplot 2 of Figure 1. The Gear Positions of the vehicle presented in Subplot 2 of Figure 1, as expected, are not well-defined. Thus, you need to estimate the minimum and maximum values of each gear and express it via an algorithm e.g. for values between A and B (y-axis of Subplot 2 of Figure 1) the corresponding Gear Position is C etc.

For this task you need to utilise both Subplots of Figure 1.

Summarise in writing your work regarding this Step.

Step 2: Based on Step 1, develop Figure 2 with two subplots.

Subplot 1: Gear Position for Lap1 (Gear Position - Sensor Signal), Gear Position vs. Distance (Miles) – same as Subplot 1 of Figure 1.

Subplot 2: Gear Position for Lap 1 (Gear Position – Processed Estimated Signal), Gear Position vs. Distance (Miles) – this Subplot should display the results obtained from Step 1.

The aim of Steps 1 and 2 is to develop an algorithm for estimating the Gear Position of a vehicle indirectly so that to provide an estimation which would be as close as possible to the Gear Position signal obtained by the Sensor (Subplot 1). Thus, Subplot 1 of each figure should be used as your reference signal whereas Subplot 2 of Figure 2 would be the processed version of Subplot 2 of Figure 1 thus, a closer approximation to Subplot 1 of Figures 1 and 2.

Hint:

a. This exercise/application may require understanding and utilisation of Conditional statements, loops, branching in Matlab. Useful tools could be the Matlab tutorial as an introductory reading and then, the Mathworks website (Control Flow section)

b. You may find useful the utilisation of the if, elseif, else Conditional Statement. However, you could apply any other algorithmic approach which will give the correct results.