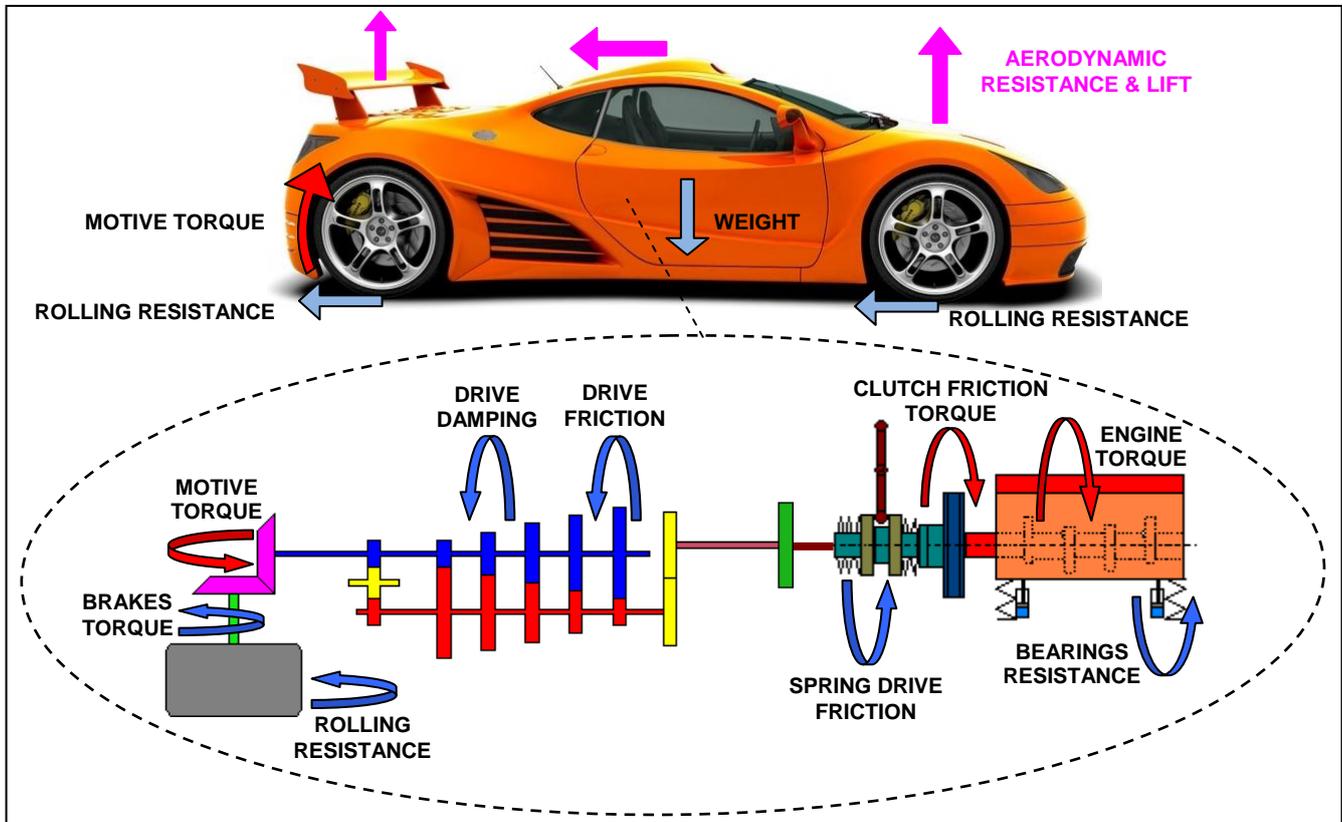


## DRIVE

### A PROGRAM FOR THE SIMULATION OF AUTOMOTIVE DRIVETRAINS



#### OVERVIEW

**DRIVE** is an application software developed with MATLAB/SIMULINK® for the simulation of automotive drive trains. In particular **DRIVE** simulates the dynamics of the whole vehicle in variable rectilinear motion during a change of gears. The DRIVE-KP variant of the program allows accurate simulation of the Kiss Point identification of a clutch.

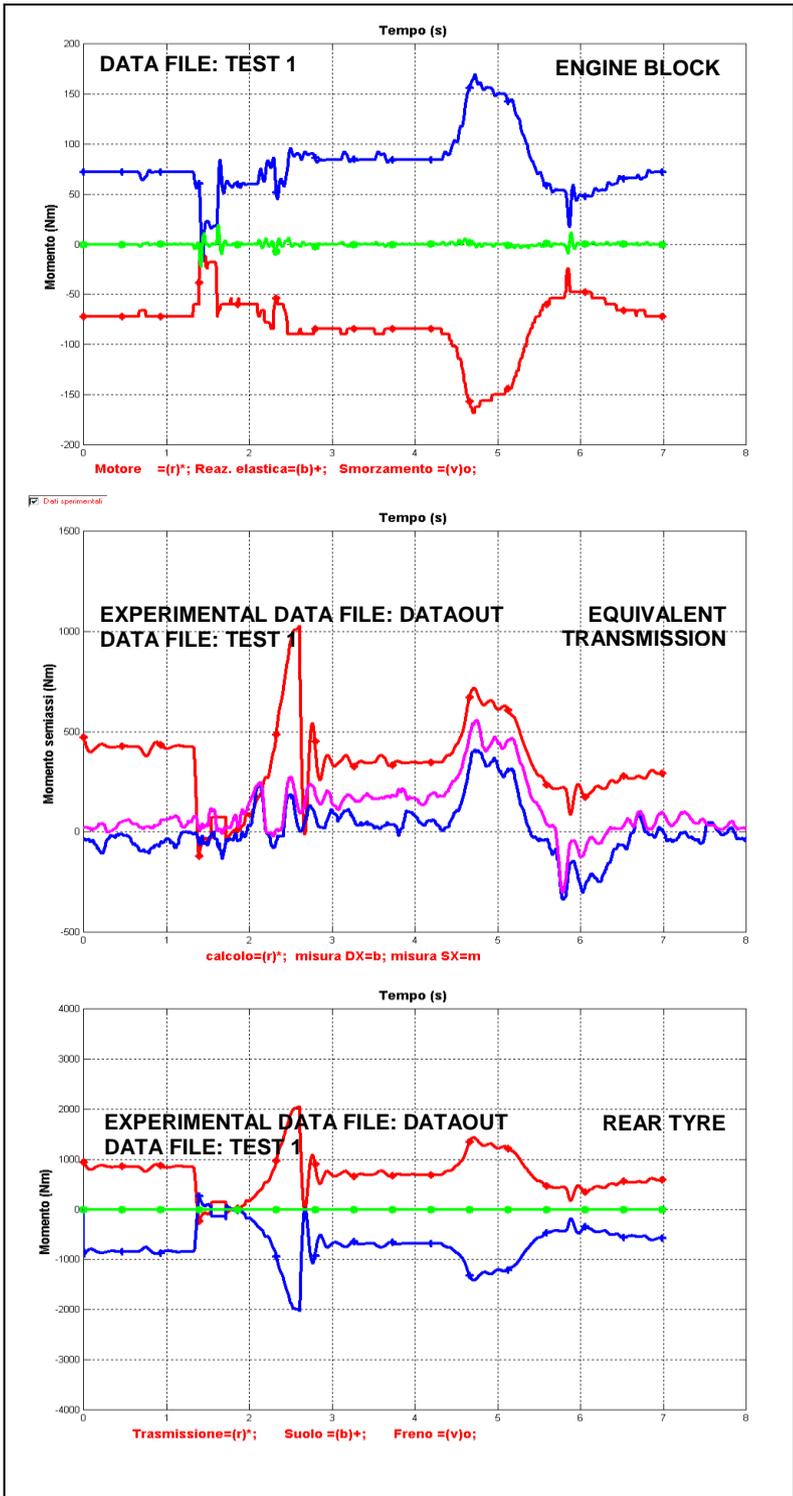
**DRIVE** is an advanced engineering tool for the design and optimisation of drive trains with manually shifted or automatic or semiautomatic transmission. The program allows the dynamic interactions that occur from the engine block through the drive train to the wheels and the car body to be studied, and provides indications about the drive train performance.

#### PROGRAM DESCRIPTION

**DRIVE** runs under the MathWorks MATLAB/SIMULINK® environment: a very powerful, qualified mathematical solver and systems simulation tool. The **DRIVE** program includes user-friendly graphic interface based on buttons and menu driven commands, which only require knowledge of basic pc use. Dynamic simulation of the whole vehicle is

performed by the simulation of several mutually interconnected subsystems, featuring:

- dynamics of the engine block, subjected to the engine torque and to the supports reaction
- engine torque, given as a function of the regulation ratio, the ignition state and the crankshaft angular velocity or as a control signal
- torque converted by the clutch as a function of its wear and temperature
- dynamics of the spring drive interacting with the clutch and the transmission
- dynamics of the transmission, including drive wheels modelled as an equivalent shaft, interacting with the spring drive and with the road surface and submitted to a friction resistance and to damping and elastic reactions
- dynamics of the car body with a 3 degrees of freedom model (longitudinal and vertical displacements and pitch rotation) subjected to weight, and to aerodynamic and rolling resistances
- vertical dynamics of tyres, considering their own elastic reaction, their weight and the suspension reaction
- rotational dynamics of tyres considering drive train torque, brakes torque and rolling resistance



**PROCEDURES OUTLINE**

The user defines the parameters of the simulation in easily editable and pre-formatted MS Excel® files, which can be stored to create a library of data sets that may be recalled for further simulations. Data include relevant dimensions, engine torque curves, cinematic and dynamic features of transmission, suspension and tyres and the modality of changing gears with its related control parameters. Engine and clutch controls can also be included as real recorded data.

Given the difficulty of identifying the correct value of some of the variables to be assigned; a semi-automatic parametric tuning tool is available to help the designer in this goal, and to match experimental data. The tool allows the best-fitting value to be chosen by calculating in an iterative manner an object function value that accounts for the difference between experimental data and numerical results.

Results of the simulation, illustrated as time histories of the calculated variables, are displayed in a variety of output plots that can be printed or exported to other environments. Numerical results can also be written in files compatible and already formatted for easy handling by spreadsheets such as MS Excel®.

Should experimental data be available, it is also possible to compare them with the results of the simulation by displaying the two sets in the same plot.

**SIMULATION SERVICES**

*DRIVE* is also used as a tool for engineering services that S.A.T.E. provides customers not wishing to enter the functions and details of the program. In this case the results of the simulations are produced as reports, together with comments and guidelines for system modifications.

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