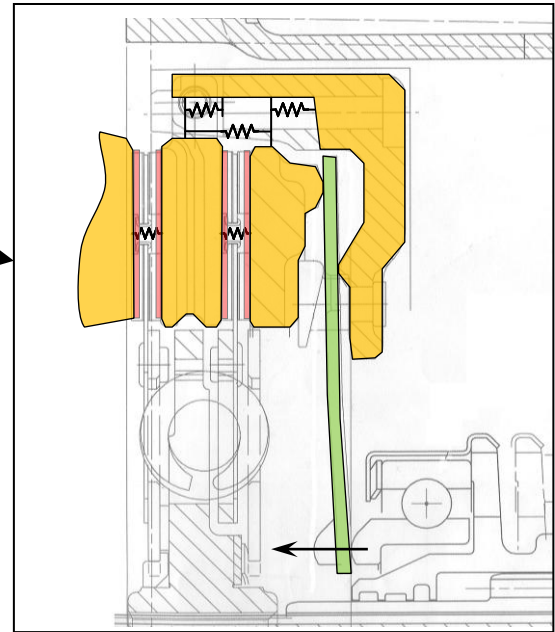
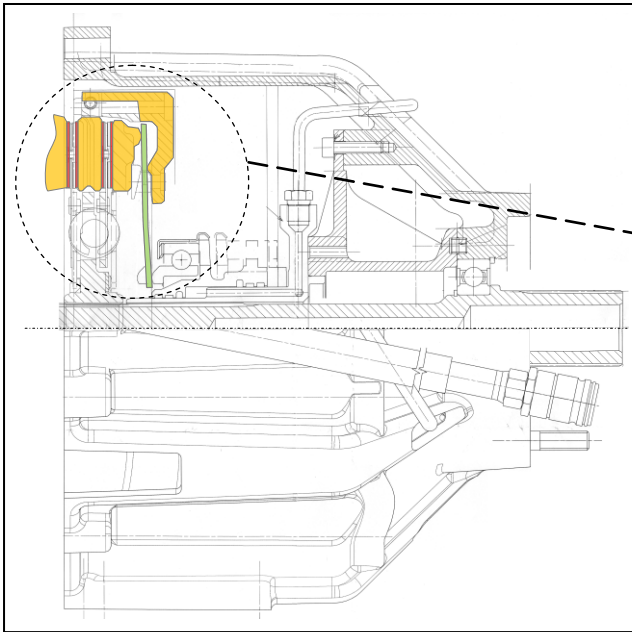


## **CLUTCH-MECH™**

**A PROGRAM FOR THE SIMULATION  
OF CLUTCH MECHANICAL BEHAVIOUR**



### **OVERVIEW**

**CLUTCH-MECH™** is an application software that simulates the dynamics of the main clutch elements as a function of experimental or calculated inputs, either static or dynamic. In particular **CLUTCH-MECH™** allows the visualisation of the calculated displacements, velocities and exchanged forces of the different elements that make up single or double disks clutches, as well as the transmitted torque.



The program permits wear effects on the different system elements to be taken into account. A variety of user-friendly interfaces are included to enable the management and representation of the various signals.

### **PROGRAM DESCRIPTION**

**CLUTCH-MECH™** has been developed in The MathWorks' MATLAB/SIMULINK®, a powerful, qualified mathematical modelling and simulation environment.

This software tool is able to evaluate the instantaneous transmitted torque during actuation cycles of a clutch, through the calculation and visualisation of the forces exchanged between different elements, thus assisting in the prediction of the clutch performance under different design solutions or material properties.

The clutch system is modelled as an assembly of axisymmetric mono-dimensional equivalent mass elements connected by linear or nonlinear elastic components.

The input data may be either experimental or theoretical. The results can be compared with data obtained from tests. The simulation results obtained can be visualized, for each element, plotting the displacements, velocities, forces, etc. as a function of time, release bearing stroke or pressure plate lift.

The **CLUTCH-MECH™** program includes user-friendly graphic interface based on buttons and menu driven commands, which only require knowledge of basic PC use.

## 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;
- mass characteristics
- elastic element characteristics;
- input signals, i.e. actuation element stroke and wear of the elements (to simulate fault-onset patterns). These may be experimental or theoretical.

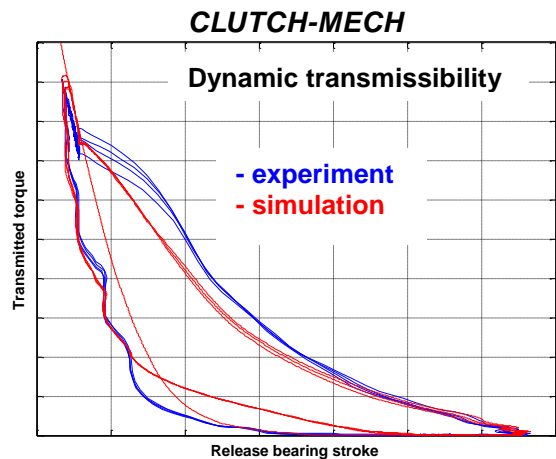
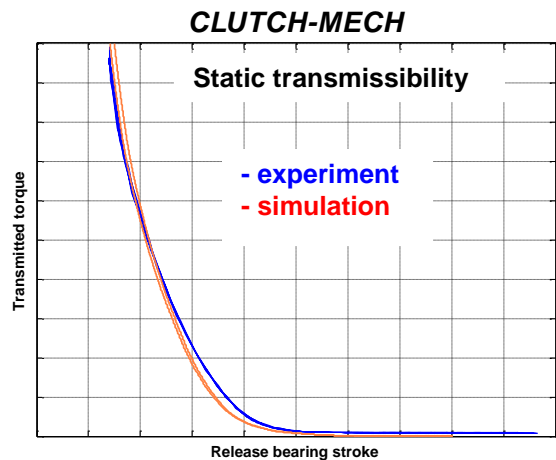
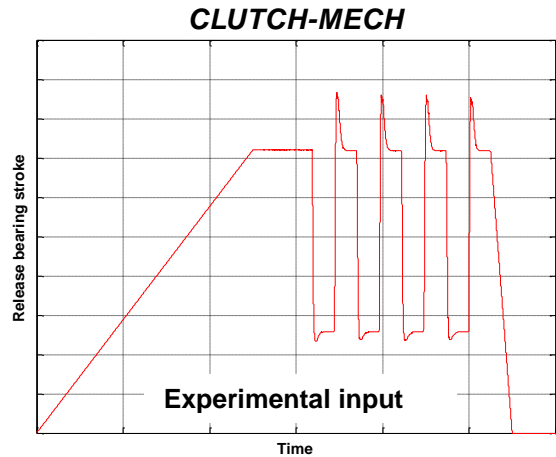
**CLUTCH-MECH™** allows the optimization of specific parameters that are not easily determined (e.g. Belleville spring geometry), to be performed based on experimental data. Results of the simulation can be displayed or exported to other environments. Numerical results in particular can be written in files compatible and already formatted for easy handling by spreadsheets such as MS Excel®.

## SIMULATION SERVICES

**CLUTCH-MECH™** is also used as a tool for engineering services provided for customers that wish to take advantages of S.A.T.E.s knowledge of 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.

## VALIDATION

**CLUTCH-MECH™** has been verified and validated with experimental data obtained from extensive static and dynamic tests, that illustrated the phenomena that affect clutch performance (i.e. thermal stress or disk wear).



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