

# Motor Starting Analysis



## Simulate the effects of induction and synchronous motor starting

The CYME power engineering software features an optional Motor Starting Analysis module for dynamic, locked rotor and maximum start size analysis which is dedicated to simulating the effects of induction and synchronous motor starting in three-phase electric power systems.

### Dynamic Motor Starting

This module is a robust and easy to use tool for assessing system voltage dips and acceleration times of motors, using a variety of starting methods.

The selection of the motor to be started along with the starting method is defined in a grid-style study dialog box. The study dialog box also gives the user the option to change the status of any motor in the network. This includes the switching of motors either to off, running, locked rotor or starting.

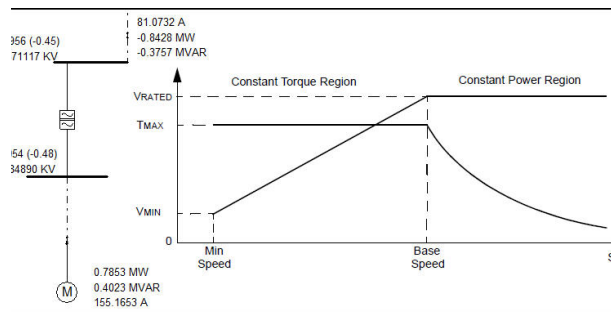
### Induction Motor Starting

The Induction Motor Starting analysis takes into account the inertial effects of the motor, user-defined load curves and supports several starting methods as listed below:

- Direct on line
- Capacitor assisted
- Resistor or inductor
- Open and closed transition auto-transformer starting
- Soft start with:
  - current ramp
  - voltage ramp
  - current limit

- Slip ring resistor insertion
- Manufacturer supplied curves
- Open and closed transition Star Delta starting
- Variable frequency drive (VFD) with the option to connect the motor to the secondary terminal of the VFD with a cable. Both operating modes for constant torque and horse power are supported

The above motor starting assistance methods are also supported in our Transient Stability module.



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## Synchronous Motor Starting

The Synchronous Motor Starting analysis takes into account the inertial effects of the motor, user-defined load curves and excitation system parameters to synchronize the motor when the speed approaches synchronous speed. The algorithm takes into account the pulsating behavior of a starting synchronous motor due to the nature of the winding connections.

The program supports several starting methods, as follows:

- Across the line starting
- Shunt capacitor-assisted starting
- Resistor and/or inductor assisted starting
- Open/closed auto-transformer starting

## Detailed Mechanical Load Model

A detailed user-defined load torque representation is provided with the program along with the opportunity to plot the nominal electrical and mechanical torque curves prior to starting the motor.

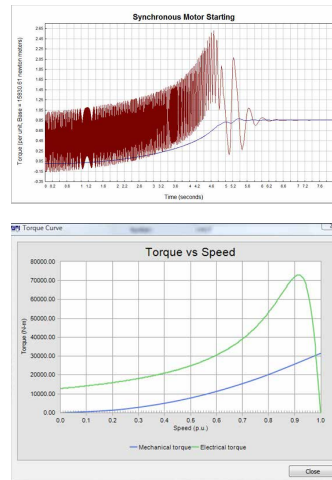
The load torque data can be entered from manufacturer data curves or with the general equation of load torque versus speed. In addition, default load curve characteristics of typical mechanical loads such as pumps, blowers, fans, feed drive and conveyer belts are also included.

## Motor Parameters Estimation

In the absence of detailed information, the module includes support functions for deducing the equivalent circuit parameters for single circuit rotor, double circuit rotor or deep bar circuit rotor induction motors, utilizing either of the following information:

- Locked rotor and no load test
- Locked rotor and load test
- Nominal conditions
- Starting conditions
- Manufacturer curve data

This module also supports the estimation of synchronous motor electrical parameters from physical quantities.



## Locked Rotor Analysis

The Locked Rotor Analysis (LRA) calculates the voltage dip of induction and synchronous starting motors on the network.

This includes the voltage dip color coding of the one-line diagram and analysis reports taking into account the number of starts per day as defined in the flicker table.

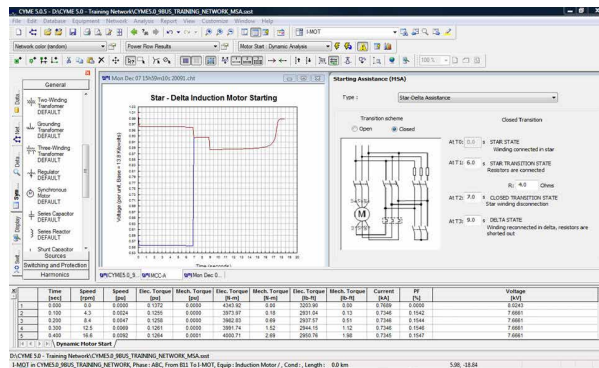
Across the line, resistor and/or inductor, capacitor, auto transformer, star/delta and variable frequency starters are supported.

## Maximum Start Size Analysis

The Maximum Start Size analysis is used to estimate the maximum motor size that can be started on a given bus or section of the network given the allowable voltage drop.

## Simulation Results

Results of the motor starting analysis can be illustrated in charts and reports to show motor bus voltage, starting current, power factor, electrical and mechanical torque versus time or speed. In addition, the time/current curve is generated for protective device coordination purposes.



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