

CATMOS®

SIMULATION PROGRAM

English

A PROGRAM FOR DYNAMIC SIMULATION OF OVERHEAD CONTACT LINES AND PANTOGRAPHS

The optimisation and development of the running characteristics of overhead contact line systems using empirical measurements is very complex, time-consuming and limits the number of variations. The results of such studies, due to the large number of environmental variables (e.g. wind, rain) and the fact that their effects cannot be reproduced, are also technically and economically unreliable.

With the CATMOS® simulation program, a large number of variations can be investigated and optimised without excessive time and cost expenditure.

CATMOS® also allows very complex overhead contact line system designs to be studied for up to eight pantographs per train. The key performance features are as follows:

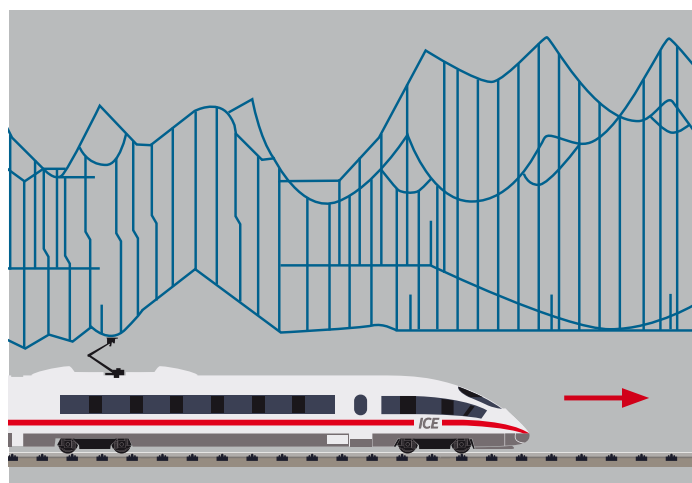
- Simulation of up to four tension lengths with different tension forces for the catenary and contact wire
- Cross-catenary spans with cross-over rod and transverse stay cables
- Catenaries with stitch wires at supporting points and additional auxiliary catenary wire
- Eight different pantographs per train
- Pantograph models with up to eight degrees of freedom

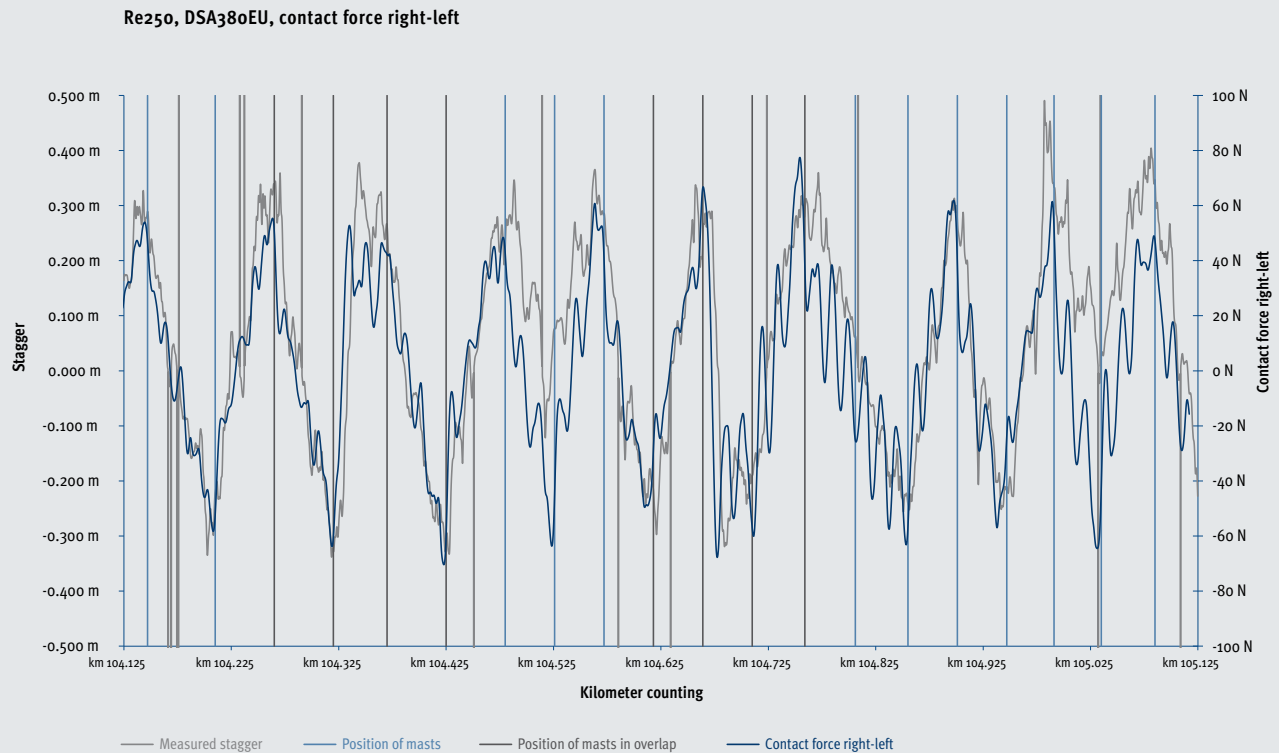
For the simulation of current collection of the overhead system it is necessary to create a mathematical model for the overhead contact line system and the pantographs.

As a result of the upward force of the pantograph, waves are generated in the overhead contact line system. The d'Alembert method is used to determine wave travel in the contact line system.

By using this method, excellent simulation results are obtained, in which non-linear characteristics of the catenary, such as buckling of the droppers, are taken into account.

To determine the characteristics of the pantographs, 10 different simulated models are available. These simulation models are made up of discrete masses, springs and shock absorbers. The masses are connected to each other by means of the springs and shock absorbers. Pantographs with up to eight degrees of freedom can be simulated, with the rotational motion of the contact strip caused by the stagger of the contact wire taken into account for these models.





Using CATMOS® simulation techniques, extensive evaluation studies can be carried out. Evaluation options include:

- Static evaluation of the contact force
- Graphic display of the assembly state, the contact force and the movements of the pantograph
- Graphic display of the movement of selected points on the catenary
- Location and duration of arcing for each contact strip of a pantograph

CATMOS® simulation techniques can be used for the following applications:

- Optimisation/simulation of existing overhead contact line systems
- Development of new overhead contact line systems
- Development/optimisation of special design modifications to fixed installations
- Study/determination of assembly tolerances
- Increased speed in existing systems using new pantographs
- Operation with multiple pantographs
- Development/optimisation of pantographs

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