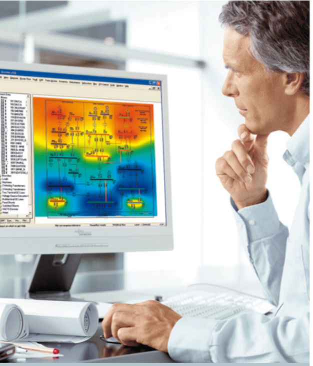

CTDim

Software program for current transformer dimensioning

At a glance

CTDim is a software program for current transformer (CT) dimensioning. Both protection and measuring cores can be considered.

The benefits of working with CTDim include:

- Dynamic check and optimization of CT requirements
- Simulation of CT transient behavior
- CT dimensioning and settings calculation for high impedance differential protection
- Automatic report generation and project oriented documentation
- Standard conversion for CT nameplate data
- Automatically customized documentation (the user can modify the report with additional comments)
- Transient simulation of CT behavior during short circuit
- Export functions, e.g. transfer of the simulated curve in COMTRADE file format
- Dimensioning of measuring CT

The challenge

The development of the digital protection technology and the introduction of gas insulated switchgear (GIS) have lead to a paradigm change in CT dimensioning. As a result, the accuracy limiting factor of the CT plays an important role, rather than the nominal burden of the CT. Unfortunately sometimes specifications regarding CTs have not been changed and are now in contradiction with the limited space reserved for CTs in GIS substations. Therefore, the optimization of CTs regarding both technical requirements of modern digital relays and economic aspects is becoming more and more important.

Our solution

CTDim makes CT dimensioning more efficient. It saves engineering and production costs by optimizing the CT data.

The program CTDim comprises the following features:

- Easy dimensioning of CT electrical data
- Database of specific CT requirements for protection devices (Siemens and other manufacturers)
- Input of CT data according to the following standards: IEC class P, PX, TPS, BS, ANSI

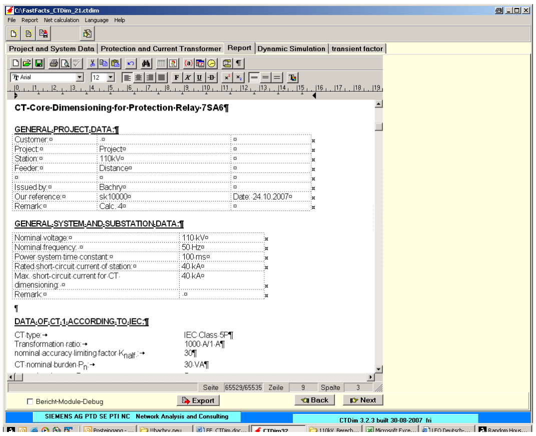

Figure 1: CT dimensioning report

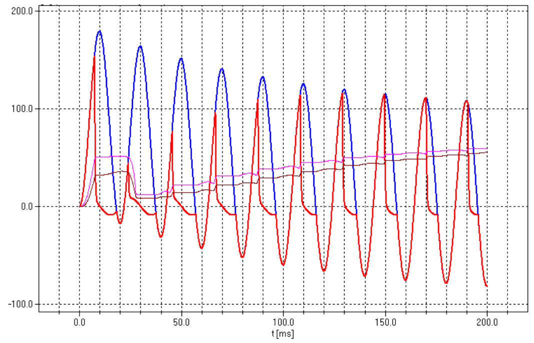

Figure 2: Transient simulation of CT behavior

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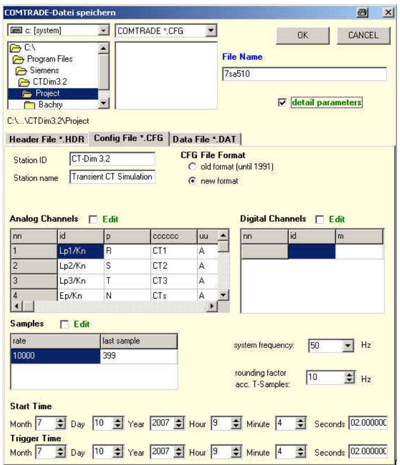

Figure 3: COMTRADE export (Windows)

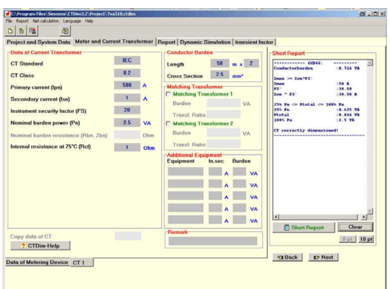

Figure 4: Data input for measuring CT

Application examples

In new substations, the process of CT dimensioning takes place at the beginning of the project planning for the switchgear. If the CTs act as an interface between primary and secondary system, a lot of clarification work has to be done at this stage of the project planning. The function of CT, which is specified according to the secondary equipment it will be connected to, has a straightforward influence on its size and in consequence on the sizing of the whole switchgear.

Therefore, it is very important that at that time the protection philosophy and the characteristic data of the equipment are known. In practice, however, it is often impossible to collect all the necessary data at this early stage. On the other hand, the primary equipment design should be decided in order to order production of the switchgear. Moreover, not only specified secondary functions, but also customers' habits play an important role in the selection and sizing of current transformers.

Thus, the CT dimensioning process is a multi-level optimization task, involving knowledge not only about the primary and secondary equipment, but also about the surrounding network in which the switchgear will be put into operation. Direct cooperation between the secondary engineering and the manufacturer of the CTs is often indispensable. In this relation, a lot of experience and feeling is necessary to manage this process.

CTDim can help to handle this process, since many scenarios can be quickly calculated and the data influencing the CT size can be optimized.

The user can carry out the simulation of CT transient behavior using the transient simulation module of CTDim. Thereby not only CT parameters can be defined, but also fault current value, primary system time constant and fault inception angle.

As a short example the figure below shows the transient simulation of a CT class 5P used for bus bar protection (Siemens 7SS52). The performance of 3000 A / 1 A CT, 5P20, 30 VA, RCT <10 Ω is simulated for 40 kA short circuit current with 100 ms primary time constant and fault inception angle of 0°.

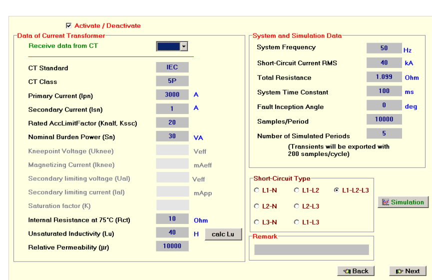

Fig. 5: Transient simulation window

As a result, the primary current (blue curve) and secondary current (red curve) are shown.

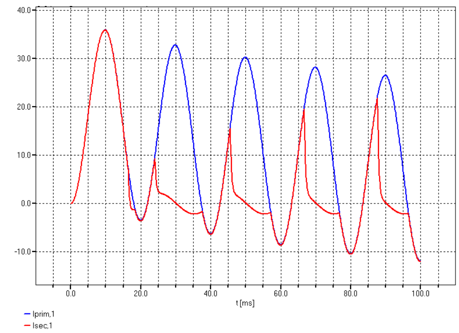

Figure 6: Transient simulation of a 3000 A / 1 A, 5P20, 30 VA CT with R_{CT}<10 Ω

In Figure 6 the time to saturation of this CT is approx. 15 ms, which is much more than the required time by 7SS52 relay (3 ms).

Very often an optimization of each core in the switchgear housing is necessary to gain more space for other cores used for distance protection, for instance.

In this case the optimized 3000 A / 1 A CT, 5P20, 2.5 VA, R_{CT}<5 Ω fulfills the requirements of the bus bar protection with enough safety margin, which is shown in the figure below.

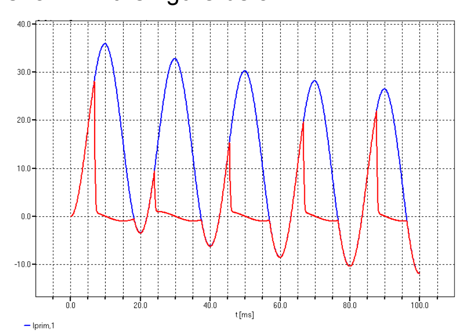

Figure 7: Transient simulation of the optimized 3000 A / 1 A, 5P20, 2.5 VA CT with R_{CT}<5 Ω

Now the time to saturation is reduced to approximately 6 ms, as shown by the simulation. This is twice the required time by the Siemens bus bar protection relay 7SS52.

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Siemens AG
Energy Sector
E D SE PTI
Freyeslebenstrasse 1
91058 Erlangen, Germany

www.siemens.com/energy/power-technologies

Siemens Energy, Inc.
Power Distribution, T&D Service Solutions
Siemens Power Technologies International
400 State Street
PO Box 1058
Schenectady, NY 12301-1058

Siemens Transmission and Distribution Ltd
PTI
Sir William Siemens House, Princess Road
Manchester, M20 2UR
United Kingdom

For more information, please contact
our Customer Support Center.
Phone: +49 180 524 70 00
Fax: +49 180 524 24 71
(Charges depending on provider)
E-mail: support.energy@siemens.com

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