ASPEN LEAFLET

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Transformer Damage Curve Made Easy

Plotting transformer damage curves is child's play in ***DistriView***™ V7, thanks to a new algorithm we just developed. A similar feature will appear in the next major release of ***OneLiner***™.

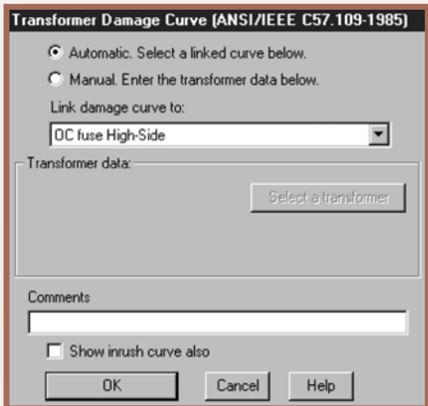

Fig. 1: Dialog box for damage curve.

The new "automatic" damage-curve feature requires the user to simply associate the damage curve with a fuse, recloser or relay that is protecting a transformer. (See Fig. 1) The program does the rest. The old method of specifying the transformer rating, impedance and base current is still there. It is now called the "manual" method. Gone is the old "link damage curve to relay curve" feature. In fact, if you had selected this link option in a previous version, you will get the new "automatic" option when you open the file with ***DistriView*** V7.

To understand the new damage-curve algorithm, it is important to note that transformer damage curves are designed to work with the maximum winding current, and that the winding current does not always equal the current sensed by the protective device. For example, for a fuse on the delta side of a wye-delta transformer, the fuse senses a phase current that enters the transformer bushing. This current is generally not the same as any of the winding currents that flow through the delta windings.

These observations led us to conclude that in order to draw a damage curve correctly for a protective device, we must shift the damage curve horizontally by the ratio *r=(max protective device current in primary amps)/(max transformer winding current on the side of the protective device)*. The following example with a wye-delta transformer demonstrates how this method works.

The first case is a single-line-to-ground fault on phase 'a' on the low side of the transformer (Fig. 2). The fault currents

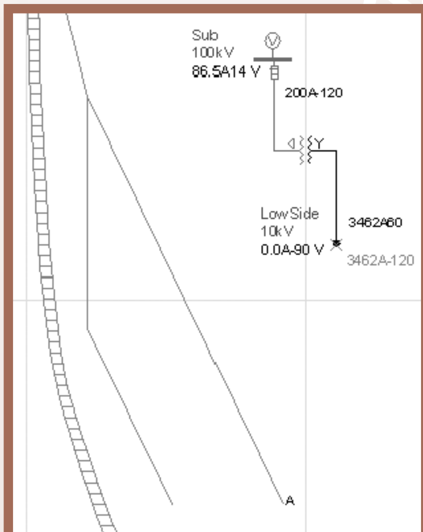

Fig. 2: Single-line-to-ground fault.

on the high side are confined to the delta winding between phases 'a' and 'c'. This is a special case in which the fuse current is exactly the same as the maximum winding current. The ratio r is equal to 1, which implies that we can draw the damage curve simply by using the transformer MVA rating and impedance, and the one-per-unit base current on the high side.

In the second case, a three-phase fault is applied to the low side bus (Fig. 3). The fault currents are balanced on both sides of the transformer. In this case, the fuse current is higher than the delta winding current by a ratio r of 1.73. To draw the damage curve for this case, we use the same method as before,

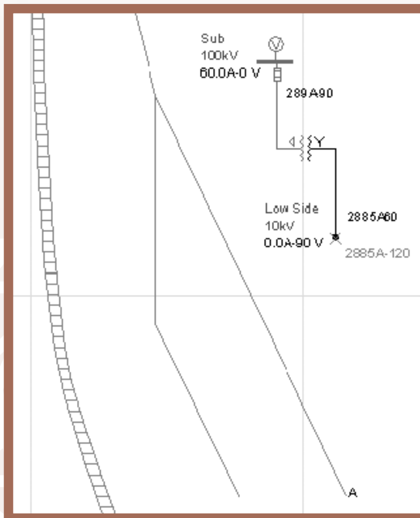

Fig. 3: Three-phase fault.

except we shift the damage curve horizontally to the right by 1.73 as the final step.

So far we have been plotting the fuse curve and the transformer damage curve as a function of the high-side current. It is a common industry practice to plot these curves on the basis of the low-side current. *DistriView* does this by first computing the fuse curve and the transformer curve for the high side as described above, and then shifting both curves to the right by the ratio of (low-side fault current)/(fuse current). This shifting preserves the separation between the fuse curve and the transformer damage curve.

The strength of our method is that it is based on physical principles, and it does not rely on any "standard" table lookup. We

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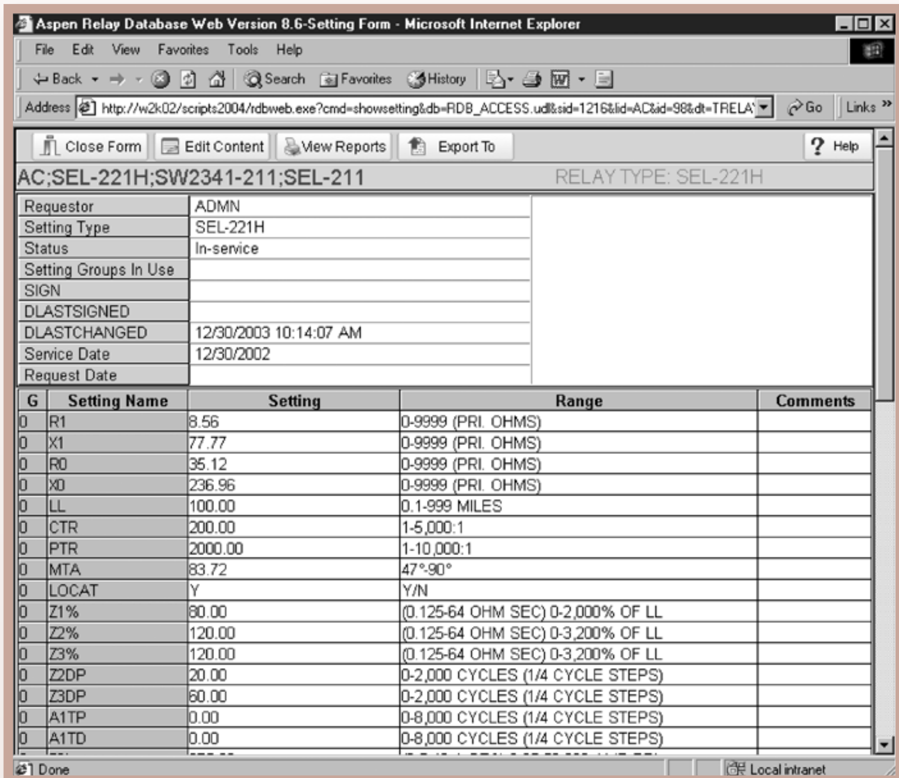

Aspen Relay Database Web Version 8.6-Setting Form - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites History

Address http://w2k02/scripts2004/rdbweb.exe?cmd=showsetting&db=RDB_ACCESS.udl&sid=1216&lid=AC&id=98&dt=TRELA' Go Links

Close Form | Edit Content | View Reports | Export To | Help

AC;SEL-221H;SW2341-211;SEL-211 RELAY TYPE: SEL-221H

Requestor	ADMN
Setting Type	SEL-221H
Status	In-service
Setting Groups In Use	
SIGN	
DLASTSIGNED	
DLASTCHANGED	12/30/2003 10:14:07 AM
Service Date	12/30/2002
Request Date	

G	Setting Name	Setting	Range	Comments
0	R1	8.56	0-9999 (PRI. OHMS)	
0	X1	77.77	0-9999 (PRI. OHMS)	
0	R0	35.12	0-9999 (PRI. OHMS)	
0	X0	236.96	0-9999 (PRI. OHMS)	
0	LL	100.00	0.1-999 MILES	
0	CTR	200.00	1-5,000:1	
0	PTR	2000.00	1-10,000:1	
0	MTA	83.72	47°-90°	
0	LOCAT	Y	Y/N	
0	Z1%	80.00	(0.125-64 OHM SEC) 0-2,000% OF LL	
0	Z2%	120.00	(0.125-64 OHM SEC) 0-3,200% OF LL	
0	Z3%	120.00	(0.125-64 OHM SEC) 0-3,200% OF LL	
0	Z2DP	20.00	0-2,000 CYCLES (1/4 CYCLE STEPS)	
0	Z3DP	60.00	0-2,000 CYCLES (1/4 CYCLE STEPS)	
0	A1TP	0.00	0-8,000 CYCLES (1/4 CYCLE STEPS)	
0	A1TD	0.00	0-8,000 CYCLES (1/4 CYCLE STEPS)	

Done Local intranet

Fig. 2: Web Interface read/write settings page.

have found from extensive testing that the method works for single or parallel transformers of any winding configuration, under classical or simultaneous faults. It works for fuses and recloser. It also works for relays that sense phase currents and transformer neutral currents, as well as those that sense Io, 3Io, I2 or 3I2.

New Features in Relay Database Web Interface

Write-enabled data forms appeared in the latest *ASPEN Relay Database*™ Web Interface for the first time. Users of the Relay Database should have received this new Web Interface with their V8.6 update in late August.

Many users have told us that they want the capability of editing setting and test data through the Web Interface. For this reason, the first forms we made write-enabled were the setting list form, the test list form, the settings form, and the test form. (See Fig. 4 for a sample settings form.) Over time, we will gradually make more and more forms write-enabled, until the entire Web Interface is read/write.

We are working to add the SQL Builder to the Web Interface. This tool will help Web Interface users query the database quickly and easily, without having to learn the SQL database language. The SQL Builder should appear in a maintenance update of the software in October.

Upcoming Events

- OneLiner Users Group Meeting:
  Morning of Monday, October 18, 2004, in Spokane, WA.
- Relay Database Seminar:
  Afternoon of Monday, October 18, 2004, in Spokane, WA.
- Hospitality Suite:
  October 18-20 in Spokane, WA, during the Western Protective Relay Conference.

More information on these events are in the News | Events page of our web site.

Relay Database Security Improved

In the latest version of the ASPEN Relay Database (V8), the user passwords are one-way encrypted. One-way encryption ensures that no one can decrypt the passwords – both practically and theoretically – even if one has access to the user-information table.

Also, since version 8.6, the administrator of the Client/Server Version can enable the “High Security” options that enforce complex password, password length, password expiration, limit on login attempts, and time-out after failure. These options substantially comply with mandates from the U.S. Homeland Security Department for databases maintained by government agencies.

New Users

OneLiner

- Allgeier, Martin & Associates, Joplin, MO
- Empresa Nacional de Electricidade, Luanda, Angola
- GE Wind Energy, Schenectady, NY
- Stanley Consultants, Muscatine, IA
- City of Saskatoon, SK, Canada
- KEMA TDC, Raleigh, NC
- Platte River Power Authority, Fort Collins, CO
- Reedy Creek Improvement District, Lake Buena Vista, FL.

Power Flow™

- GE Wind Energy, Schenectady, NY

DistriView

- Hydro Ottawa, Ottawa, ON, Canada
- Unisource Energy Services, Tucson, AZ
- Baccari & Associates, Sheridan, WY
- TriAxis Engineering, Corvallis, OR

Line Constants Program™

- Chelan County PUD, Wenatchee, WA
- Saudi Consolidate Electricity Co. -Southern Region, Abha, Saudi Arabia
- Seattle City Light, WA
- KEMA TDC, Raleigh, NC
- MSE Power Systems, Albany, NY
- Ulteig Engineers, Minneapolis, MN

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