Technical Note 144

Calculating Harmonics with Electrical Network Modeling Tools

How to use the ABB Harmonic Estimator to create profiles

A request for harmonic data often comes from those using third-party analysis tools to calculate the harmonics of electrical systems based on the details of an existing or proposed one-line diagram. Although it is common to get such a request for the harmonic profile of a particular ABB drive, it is often possible to enter a general value for the drive's converter design and the type of mitigation. For example, for ACS880-01 drives, R1-R9 drives have DC Bus Chokes, R10 to 2xD8T+3xR8i drives have AC line reactors. So, you can model the drives in the analysis tool with 3% impedance DC bus chokes for the smaller drives or 3% AC line reactors for the larger drives.

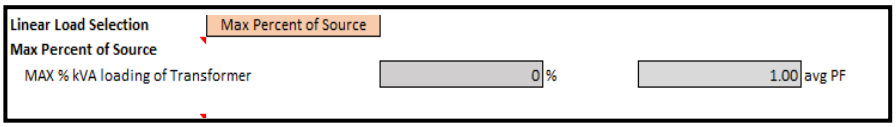
In practice, the above method of selecting the general characteristics of the drive's converter section and type of mitigation would often be sufficient to make a useful estimation. There may be times though when more specific data is needed. Using ABB's Harmonic estimation tools to create the results for a limited set of data would be a way to accomplish that.

It is important to note that the harmonic results are dependent on the system in which the drive is installed. This means that the size of the supply transformer and its impedance can have an effect on the resulting harmonics. It is possible to create the profile for a particular drive based on the network that you have in mind by using the ABB Harmonic Estimator.

Example

For a 100 HP ACS880 drive on a 1000 KVA 5.75% impedance transformer using the ABB Harmonic Estimator tool ABB Library - 9AKK107046A0326 here is the input data that was entered:

Source Selected	UTILITY
Utility [V]	13800
Utility [MVAsc]	400
Transformer ID Tag	
Rated kVA [kVA]	1000
Secondary Voltage [V]	480
Impedance [% Z]	5.75
PCC for Vthd	XFMR Sec
PCC for TDD	XFMR Sec



VFD #	ID Tag	Drive	Additional Filter	Rated HP	% Load	Input cable, ft
1	ACS880 VFD1	6 Pulse w/ 3% Impedance		100.00	100.0%	
2					100.0%	
3					100.0%	

This entry data gives the following results in the report section.

Table 1

h	Current [A]	Ih [%]	IEEE TDD Limits [%]		Voltage[V]	Vh [%]
1	3.4	100.00	100.00		480.00	100.00
2	0.0	0.03	3.75		0.00	0.00
3	0.0	0.29	15.00		0.41	0.08
4	0.0	0.03	3.75		0.00	0.00
5	1.6	45.16	15.00	x	5.34	1.11
6	0.0	0.00	3.75		0.00	0.00
7	0.6	16.94	15.00	x	2.81	0.58
8	0.0	0.02	3.75		0.00	0.00
9	0.0	0.04	15.00		0.17	0.03
10	0.0	0.01	3.75		0.00	0.00
11	0.3	7.56	7.00	x	1.97	0.41
12	0.0	0.00	1.75		0.00	0.00
13	0.1	3.55	7.00		1.09	0.23
14	0.0	0.01	1.75		0.00	0.00
15	0.0	0.02	7.00		0.15	0.03
16	0.0	0.01	1.75		0.00	0.00
17	0.1	3.72	6.00		1.50	0.31
18	0.0	0.00	1.50		0.00	0.00
19	0.1	1.49	6.00		0.67	0.14
20	0.0	0.01	1.50		0.01	0.00
21	0.0	0.01	6.00		0.15	0.03
22	0.0	0.01	1.50		0.00	0.00
23	0.1	2.10	2.50		1.14	0.24
24	0.0	0.00	0.63		0.00	0.00
25	0.0	0.92	2.50		0.55	0.11
26	0.0	0.01	0.63		0.01	0.00
27	0.0	0.01	2.50		0.14	0.03
28	0.0	0.01	0.63		0.01	0.00
29	0.0	1.23	2.50		0.84	0.18
30	0.0	0.00	0.63		0.00	0.00
31	0.0	0.63	2.50		0.46	0.10
32	0.0	0.01	0.63		0.01	0.00
33	0.0	0.01	2.50		0.14	0.03
34	0.0	0.13	0.63		0.10	0.02
35	0.0	0.81	1.40		0.67	0.14
36	0.0	0.01	0.35		0.11	0.02
37	0.0	0.39	1.40		0.34	0.07
38	0.0	0.13	0.35		0.11	0.02
39	0.0	0.01	1.40		0.14	0.03
40	0.0	0.13	0.35		0.12	0.03
41	0.0	0.56	1.40		0.55	0.11
42	0.0	0.01	0.35		0.13	0.03
43	0.0	0.25	1.40		0.25	0.05
44	0.0	0.13	0.35		0.13	0.03
45	0.0	0.01	1.40		0.14	0.03
46	0.0	0.13	0.35		0.14	0.03
47	0.0	0.43	1.40		0.48	0.10
48	0.0	0.01	0.35		0.14	0.03
49	0.0	0.18	1.40		0.21	0.04
50	0.0	0.13	0.35		0.15	0.03

Harmonic [A]	1.7	Arms	**Harmonic [V]**	7.0	Vrms
Fund [A]	3.4	Arms	**Fund [V]**	480.0	Vrms
TDD [%]	49.2		**vTHD [%]**	1.4	

The above data can then be used as a profile for the drive with the magnitudes of the individual harmonics and used to entered into the third-party tool to model the drive.