

A new Implementation of the N-D Lookup Tables

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The HDF5Table library is an open-source solution for the efficient handling, exchange and interpolating access of typical data sets in system simulation. The library consists of C-functions, python scripts and examples and can be used with different applications like Modelica or Simulink. Furthermore a comprehensive set of tools that allows the user to create, migrate, edit, compare and manage the datasets is available. The application range covers data import from measurements or other simulations, integration of datasets in preprocessing routines, the usage of the datasets in the simulation and the post processing of simulation results. To eliminate a major source of errors after data exchange between simulation tools or different companies and to validate the datasets each dataset can have a physical unit and quantity attached to it. The table data can be easily accessed with different methods for inter- and extrapolation. To persist and exchange the data sets a subset of the HDF5 [1] standard is used. With the HDF5 API the data access is fast for large files with many variables containing millions of values and the datasets can be opened in many other tools.

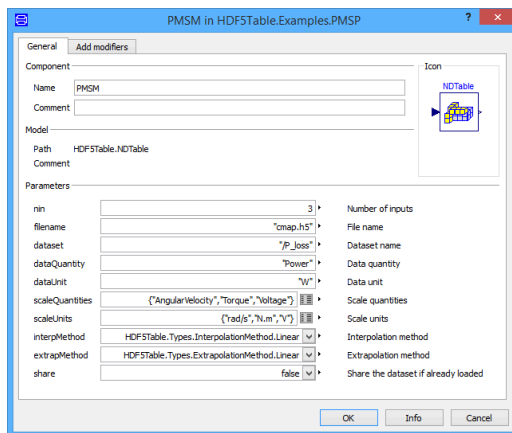


Figure 1 NDataTable block parameters

Name	Value	Unit	Comment
P_loss	<16x20x2>	W	Power losses
eta	<16x20x2>		Efficiency
tau	<20>	N.m	Torque
u	[200, 450]	V	Source voltage
w	<16>	1/min	Rotational speed

Rotational Speed / 1/min	Torque / N.m									Voltage: 200 V
0	-230	-205	-180	-155	-130	-105	-80	-55	-30	NaN
1000	6718.942	5359.567	4156.442	3109.567	2218.942	1484.567	906.442	484.567	218.942	NaN
2000	6835.72	5476.345	4273.22	3226.345	2335.72	1601.345	1023.22	601.345	335.72	NaN
3000	6973.169	5613.794	4410.669	3363.794	2473.169	1738.794	1160.669	738.794	473.169	NaN
4000	7141.624	5782.249	4579.124	3532.249	2641.624	1907.249	1329.124	907.249	641.624	NaN
5000	7351.42	5992.045	4788.92	3742.045	2851.42	2117.045	1538.92	1117.045	851.42	NaN
6000	7612.894	6253.519	5050.394	4003.519	3112.894	2378.519	1800.394	1378.519	1112.894	NaN

Figure 2 HDF5 dataset editor

A number of solutions exist for Modelica [2] and other simulation platforms that suffer from different limitations and problems the proposed implementation together with a set of supporting tools is trying to solve. The above figures show the parameters dialog of the Modelica block and the corresponding HDF5 data file that contains the three-dimensional table with scales, units and quantities.

References

- [1] HDF5 Software Documentation, <http://www.hdfgroup.org/HDF5/doc/index.html>
- [2] Call for Quotation of an Open Source Implementation of the MSL Table Interpolation Blocks, https://www.modelica.org/news_items/call-texts-to-improve-modelica-2012/2012-12-20-Call-for-quotation-for-MSL-tables.pdf/at_download/file