LAWA

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This document describes the usage of software package LAWA (**L**ibrary for **A**daptive **W**avelet **A**pplications) for the PhD thesis *On the adaptive tensor product wavelet Galerkin method with applications in finance.*

Contributors: It is important to note that the library itself is a group project with the following members (listed in lexicographical order):
Iris Häcker, Sebastian Kestler, Michael Lehn, Mario Rometsch, Andreas Rupp, Kristina Steih, Alexander Stippler

I am very grateful to Mario Rometsch and Alexander Stippler for providing the underlying (adaptive) wavelet framework, Michael Lehn for answering all my questions concerning FLENS and his Doctool, Kristina Steih (and again Alexander Stippler) for their efforts in restructuring the library and Andreas Rupp for providing the construction of L_2-orthonormal multiwavelets.

1 Documentation

1.1 Required packages

- BOOST, GSL
- FLENS (customized)
- On Unix systems: BLAS, LAPACK,
- On Mac OS X: Accelerate Framework

1.2 Other used packages

We also used the following software provided under the GPL. At this point, we would like to the authors for kindly providing their algorithms.

- Sparse grid quadrature: John Burkardt
- Cholesky decomposition: Gunter Winkler, Konstantin Kutzkow
- DocTool: Michael Lehn

1.3 Environment variables

Before starting, you need to set several environment variables:

- FLENS_HOME: path to the FLENS-lite folder
- LAWA_HOME: path to the LAWA-lite folder
- BOOST_HOME: path to the BOOST folder (headers)
- GSL_INC_HOME: path to the GSL folder (headers)
- GSL_INC_HOME: path to the GSL folder (lib)

This can also be found in the file `.Lawa-liteProfile` in the source folder. Please note that environment variables for *multiprecision* do not need to be set – they are only for experimental purposes.

1.4 Configuration

All required configuration can be found in the config file in the source folder.

1.4.1 Mac OS X

LAWA has been successfully used on all recent Mac OS X systems with the compilers gcc (Versions 4.2.1 and 4.4) and clang.

1.4.2 Unix

I used the provided library on UBUNTU 10.04 in conjunction with gcc (Version 4.4). Here, I installed the following packages:

- libblas-test, libblas-dev, libblas3gf
- liblapack3gf
- liblapack3gf-base

1.4.3 Windows

Has not been tested.

1.5 `html` documentation

In the folder `LAWA-lite/doc/sites` you find the `html` file `index.html`. Here, you find all currently available documentation for explanatory examples as well as for the programs used for the PhD thesis. The latter one can be found under *projects based on* LAWA.

2 Notes

2.1 Checks

- The variable JMINOFFSET in `lawa/methods/adaptive/datastructures/index.h` needs to be larger or equal to zero when using wavelet algorithms on bounded domains. For unbounded domains, this variable should be chosen such that JMINOFFSET + j_0 (minimal level of univariate basis/bases) is nonnegative. Otherwise, one may encounter undefined behavior.
- As a standard, `long int` is used for storing translation indices in an `Index1D` object. However, also `int` can be used. This is of advantage when lack of working memory becomes an issue.
- The comments ("//") in front of the calls of F.initializePropagation in `lawa/methods/adaptive/solvers/multitreeawgm.tcc` have to removed in order to use the AWGM within option pricing problems (or, more general, the AWGM in conjunction with a θ-scheme for time discretization). This should be fixed in a later version.

3 Setting for Eclipse

I used Eclipse (Galileo) for programming. For this purpose I set up a *makefile project* and used the following settings for the project properties:

- *C/C++ Build*: Build directory is the path to LAWA-lite.
- *C/C++ Build – Environment*: Set variables LAWA_HOME, BOOST_HOME, FLENS_HOME, GSL_INC_HOME, GSL_LIB_HOME and PWD
- *C/C++ Build – Settings*: Activate Mach-O-Parser
- *C/C++ General – File types*: Added `*.tcc`.