

## Siesta 4.1.5

### Webpage

<https://gitlab.com/siesta-project/siesta>

### Version

4.1.5 (+ELPA 2021.05.002)

### Build Environment

- Intel Compiler 19.1.2 (Intel Parallel Studio 2020 Update 2)
- Intel MKL 2020.0.2 (Intel Parallel Studio 2020 Update 2)
- Intel MPI 2018.0.4 (Intel Parallel Studio 2018 Update 4)

### Files Required

- siesta-v4.1.5.tar.gz
- arch.make

```
.SUFFIXES:
.SUFFIXES: .f .F .o .c .a .f90 .F90

SIESTA_ARCH = rccs-intel20-mkl

CC = mpiicc
FPP = $(FC) -E -P -x c
FC = mpiifort
FC_SERIAL = ifort
FFLAGS = -O2 -fPIC -xHost -fp-model source

AR = ar
ARFLAGS_EXTRA =
RANLIB = ranlib

SYS = nag

SP_KIND = 4
DP_KIND = 8
KINDS = $(SP_KIND) $(DP_KIND)

DEFS_PREFIX =

LDFLAGS =
FCFLAGS_fixed_f = -fixed
FCFLAGS_free_f90 = -free
FPPFLAGS_fixed_F = -fixed
FPPFLAGS_free_F90 = -free

BLAS_LIBS = -mkl=sequential
LAPACK_LIBS = -mkl=sequential
SCALAPACK_LIBS = -L$(MKLROOT)/lib/intel64 -lmkl_scalapack_lp64 -lmkl_blacs_intelmpi_lp64 -lmkl_intel_lp64 -lmkl_sequential -lmkl_core -lpthread -lm
-ldl

COMP_LIBS =

NETCDF_ROOT = /local/apl/lx/siesta415/exts
NETCDF_INCFLAGS = -I$(NETCDF_ROOT)/include
NETCDF_LIBS = -L$(NETCDF_ROOT)/lib -lnetcdf -lnetcdf

MPI_INTERFACE = libmpi_f90.a
MPI_INCLUDE = .
```

```

FPPFLAGS = $(DEFS_PREFIX)-DFC_HAVE_ABORT -DSIESTA__ELPA -DMPI -DCDF -DFC_HAVE_ABORT -DFC_HAVE_FLUSH

LIBS = $(NETCDF_LIBS) $(SCALAPACK_LIBS) $(LAPACK_LIBS) $(MPI_LIBS) $(COMP_LIBS)

FFLAGS_DEBUG = -g -O1 -fp-model source

# ELPA
ELPA_ROOT = /local/apl/lx/siesta415/exts
ELPA_INCFLAGS = -DSIESTA__ELPA -I$(ELPA_ROOT)/include/elpa-2021.05.002/modules
ELPA_LIBS = -L$(ELPA_ROOT)/lib -lelpa

LIBS += $(ELPA_LIBS)
FPPFLAGS += $(ELPA_INCFLAGS)

atom.o: atom.F
    $(FC) -c $(FFLAGS_DEBUG) $(INCFLAGS) $(FPPFLAGS) $(FPPFLAGS_fixed_F) $<
state_analysis.o: state_analysis.F
    $(FC) -c $(FFLAGS_DEBUG) $(INCFLAGS) $(FPPFLAGS) $(FPPFLAGS_fixed_F) $<

.c.o:
    $(CC) -c $(CFLAGS) $(INCFLAGS) $(CPPFLAGS) $<
.F.o:
    $(FC) -c $(FFLAGS) $(INCFLAGS) $(FPPFLAGS) $(FPPFLAGS_fixed_F) $<
.F90.o:
    $(FC) -c $(FFLAGS) $(INCFLAGS) $(FPPFLAGS) $(FPPFLAGS_free_F90) $<
.f.o:
    $(FC) -c $(FFLAGS) $(INCFLAGS) $(FCFLAGS_fixed_f) $<
.f90.o:
    $(FC) -c $(FFLAGS) $(INCFLAGS) $(FCFLAGS_free_f90) $<

```

- elpa-2021.05.002.tar.gz
- netcdf-c-4.8.1.tar.gz
- netcdf-fortran-4.5.3.tar.gz

## Build Procedure

### ELPA-2021.05.002

```

#!/bin/sh

VERSION=2021.05.002
INSTDIR=/local/apl/lx/siesta415/exts
WORKDIR=/work/users/${USER}

BASEDIR=/home/users/${USER}/Software/ELPA/${VERSION}
TARBALL=${BASEDIR}/elpa-${VERSION}.tar.gz

PARALLEL=12

# -----
umask 0022
ulimit -s unlimited

module purge
module load intel/19.1.2
module load mpi/intelmpi/2018.4.274
module load mkl/2020.0.2

export LANG=C
export LC_ALL=C

export FC=mpiifort
export CC=mpiicc
export CXX=mpiicpc
export FCFLAGS=-I${MKLROOT}/include/intel64/lp64/

```

```

# mkl_link_tool -libs -c intel_f -p no --cluster_library=scalapack
export LDFLAGS="-L${MKLRROOT}/lib/intel64 -lmkl_scalapack_lp64 -lmkl_blacs_intelmpi_lp64 -lmkl_intel_lp64 -lmkl_sequential -lmkl_core -lpthread -ldl"

cd ${WORKDIR}
if [ -d elpa-${VERSION} ]; then
  mv elpa-${VERSION} elpa-erase
  rm -rf elpa-erase &
fi
tar xzf ${TARBALL}
cd elpa-${VERSION}

./configure --prefix=${INSTDIR}
make -j ${PARALLEL}
make check
make install

```

## Siesta

(ELPA must be installed before Siesta.)

```

#!/bin/sh

VERSION=4.1.5
INSTDIR=/local/apl/lx/siesta415
WORKDIR=/work/users/${USER}
BASEDIR=/home/users/${USER}/Software/Siesta/${VERSION}
TARBALL=${BASEDIR}/siesta-v${VERSION}.tar.gz
ARCHMAKE=${BASEDIR}/arch.make

NETCDF_C_VERSION=4.8.1
NETCDF_F_VERSION=4.5.3
BASEDIR_NETCDF=/home/users/${USER}/Software/NETCDF
TARBALL_NETCDF_C=${BASEDIR_NETCDF}/c${NETCDF_C_VERSION}/netcdf-c-${NETCDF_C_VERSION}.tar.gz
TARBALL_NETCDF_F=${BASEDIR_NETCDF}/f${NETCDF_F_VERSION}/netcdf-fortran-${NETCDF_F_VERSION}.tar.gz

PARALLEL=12 # NOTE: parallel make cannot be used for siesta

#-----
umask 0022
ulimit -s unlimited

module purge
module load intel/19.1.2
module load mpi/intelmpi/2018.4.274
module load mkl/2020.0.2

export LANG=C
export LC_ALL=C
export FC=ifort
export CC=icc

cd ${WORKDIR}
if [ -d netcdf-c-${NETCDF_C_VERSION} ]; then
  mv netcdf-c-${NETCDF_C_VERSION} netcdf-c-erase
  rm -rf netcdf-c-erase &
fi
tar xzf ${TARBALL_NETCDF_C}
cd netcdf-c-${NETCDF_C_VERSION}

./configure --prefix=${INSTDIR}/exts
make -j${PARALLEL}
make -j${PARALLEL} check
make install

export PATH="${PATH}:${INSTDIR}/exts/bin"

```

```

export CPATH="${CPATH}:${INSTDIR}/exts/include"
export LD_LIBRARY_PATH="${LD_LIBRARY_PATH}:${INSTDIR}/exts/lib"
export LIBRARY_PATH="${LIBRARY_PATH}:${INSTDIR}/exts/lib"

cd ${WORKDIR}
if [ -d netcdf-fortran-${NETCDF_F_VERSION} ]; then
  mv netcdf-fortran-${NETCDF_F_VERSION} netcdf-fortran-erase
  rm -rf netcdf-fortran-erase &
fi
tar zxf ${TARBALL_NETCDF_F}
cd netcdf-fortran-${NETCDF_F_VERSION}

./configure --prefix=${INSTDIR}/exts
make -j${PARALLEL}
make -j${PARALLEL} check
make install

cd ${INSTDIR}
if [ -d siesta-v${VERSION} ]; then
  mv siesta-v${VERSION} siesta-erase
  rm -rf siesta-erase
fi
tar zxf ${TARBALL}
mv siesta-v${VERSION}/* .
rmdir siesta-v${VERSION}

# hidoiyo...
echo >> Tests/OMM_h2o/OMM_h2o.fdf
echo >> Tests/OMM_si/OMM_si.fdf

mkdir bin # install dir

cd Obj
./Src/obj_setup.sh
cp ${ARCHMAKE} ./arch.make

# build transiesta
cd ${INSTDIR}/Obj && make transiesta
# build siesta
make clean-transiesta && make

# utils
cd ${INSTDIR}/Util
echo "m_cite.o: version.o" >> Gen-basis/Makefile
sh build_all.sh

# test siesta & transiesta
cd ${INSTDIR}/Obj/Tests
make MPI="mpirun -np 2" SIESTA="${INSTDIR}/Obj/siesta" check >& make_check.log
make MPI="mpirun -np 2" TS="${INSTDIR}/Obj/transiesta" tests-ts >& make_check_ts.log
cd ../
mv siesta ${INSTDIR}/bin
mv transiesta ${INSTDIR}/bin

```

## Tests

### ELPA

```

# TOTAL: 100
# PASS: 39
# SKIP: 54
# XFAIL: 0
# FAIL: 7
# XPASS: 0
# ERROR: 0

```

Even if gfortran or other version of Intel compiler was employed (MKL was employed in any case), those 7 tests failed.

## NetCDF

- `tst_charvlenbug.c`: failed to build

## Siesta

- `ar2_vdw`: minor numerical error
- `dipole_correction`: minor numerical error
- `fe_clust_noncollinear`: minor(?) numerical error
- `fe_cllust_noncollinear-gga`: minor(?) numerical error
- `fe_nocol_kp`: minor numerical error
- `gate_G_charge`: minor numerical error
- `ge111`: minor numerical error
- `graphite_c6_full`: minor(?) numerical error at least in the final result
- `h2o_orderN`: minor(?) numerical error
- `mix_broyden`: minor numerical error
- `mix_pulay`: minor(?) numerical error
- `ptcda-au`: minor numerical error
- `si001-diags_mrrr`: exec error (since MRRR is not installed?)
- `sic-slab`: minor numerical error
- `sih_fire`: minor numerical error at least in the final result(?)
- `sinw_2`: minor numerical error
- `var_cell`: minor(?) numerical error
- `wannier`: exec error (since wannier90 is not installed?)
- `zmatrix`: ?output style itself is different?

## Notes

- Intel 2020 MPI doesn't work well for Siesta 4.1.5
- Intel version seems to be faster than GCC one
- utilities in Util directory is not checked (i dunno how to check them)
- binary executables (`siesta`, `transiesta`) were moved from `Obj/` to `bin/` directory.