BLUPF90 AND RELATED PROGRAMS (BGF90)

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COMPUTING METHODS

BGF90 is a collection of software in Fortran 90 useful for breeding & genetics applications. The package consists of library modules and application programs. The modules are designed with overloading and optional parameters so that their use is simple. Whenever applicable, the modules use well-tested low-level software in Fortran 77 or Fortran 90. The application programs deliberately avoid low-level optimization for simplicity but support a wide range of models, including those with multiple-correlated effects, multiple animal models and dominance, and they can be modified to support new features. For general description of the package, see Misztal (1999).

Available modules include:
SPARSEM - sparse matrix manipulation on matrices in IJA and hash formats; solutions by succesive overrelaxation and preconditioned conjugate gradient.
SPARSEOP - sparse matrix finite operations including factorization and inversion; uses FSPAK90 by Misztal and Perez-Enciso (1998) and FSPAK by Perez-Enciso et al. (1994).
DENSEOP - dense matrix operations for factorization, solution, inversion and computations of eigenvalues and eigenvectors on half- and full-stored matrices in single and double precision; uses LAPACKF90 by Miller (2002).
PROB - probability routines for use in threshold models and Gibbs sampling; uses RANLIB.F90.
GIBBS - operations useful for data manipulation in Gibbs sampling.

Available application programs include:
BLUPF90 - BLUP in memory ; REMLF90 - accelerated EM REML
AIREMLF90 - Average Information REML; CBLUPF90 - Solutions for bivariate linear-threshold models; CBLUP1F90 -as above but with thresholds computed and many linear traits; CBLUP2F90 - as above but with quasi REML; GIBBSF90 - simple block implementation of Gibbs sampling; GIBBS2F90 - as above but with storing of only single-trait matrices and joint sampling of correlated effects; POSTGIBBSF90 - graphical tool for post-Gibbs analysis.

The following programs are available by request:
THRGIBBSF90 - a modification of GIBBS2F90 for any combination of categorical and linear traits; MRF90 - Method R program suitable for very large data sets (Druet et al., 2001).

Programs below are available only under special agreement:

BLUP90IOD - BLUP by iteration on data with support for very large problems (Tsuruta et al. (2001); CLUP90IOD - as above for threshold-linear models.

USE

The programs have been used for many projects in many species. For example, REMLF90 was used for up to 5 traits and 4th order polynomials in random regression models, GIBBS2F90 was used for 18-trait random regression model with missing traits and different models per trait, and for a 3-trait beef animal model for over 400,000 animals. BLUP90IOD and CBLUP90IOD were used for genetic evaluation of national populations of beef and dairy cattle.

Because of availability of source code and emphasis on simple programming, programs in BGF90 can be readily understood and modified to incorporate new models or methodologies. However, they may be not as easy to use and integrated as some of the other packages. BGF90 would be most useful to graduate students and research scientists with a good knowledge of mixed models.

AVAILABILITY

Most of programs in sources form and selected binaries under Linux and Windows are available through http://nce.ads.uga.edu/~ignacy. All but iteration-on-data programs are free to use for noncommercial applications.

COMPUTING ENVIRONMENT

The programs are available as a package with for compilation under several Unix systems including Linux. Setting up the package on a new system and compilations are automated through Makefiles. Compilations require a commercial Fortran 90 compiler. Additionally, binaries for some application programs are available under Linux and Microsoft Windows. An integrated package with GUI under Windows is available from M. Duangjinda (monchai@kku.ac.th).

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