50 years of the mathematical software library HSL

John Reid

Numerical Analysis Group,

STFC Scientific Computing Department

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Summer 1961

- My story begins as a research student at Harwell in 1961 in Theoretical Physics division.
- Jack Howlett was my (very benign) boss. He was in the final stages of negotiating the birth of Atlas.
- I worked on a Mercury computer, which occupied a whole room, had a 1k memory of 40-bit words, and a 32k drum. It did have floating-point arithmetic. Used valves and was unreliable.
- My supervisor was Ian Pyle. With Alan Curtis, he wrote the initial Fortran compiler for Atlas. It was written in Fortran by “boot-strapping”, with only utility subroutines written in Atlas assembly.

1963 Birth of Harwell Subroutine Library, HSL

- Most Harwell computing in 1963 on an IBM 7090 at Aldermaston.
- Jobs transferred by magnetic tapes in a van, with a satellite IBM at Harwell reading cards onto tape and printing results from tape.
- Scientists doing their own programming, mainly in Fortran.
- Big improvements possible by writing subroutines once, using good numerical analysis, for use in many applications.
- 90 subroutines in IBM Fortran for special functions, approximation, ODEs, quadrature, linear algebra, sorting, optimization, …
- Brainchild of Mike Powell.

HSL at Harwell to 1990

- Began by coding existing algorithms
- Importance of associated research gradually realized.
- Research of international standing performed in optimization, approximation, stiff ordinary differential equations, large sparse linear algebra, …, all with implementations as HSL subroutines.
- International reputation meant that HSL was in demand outside.
- Portability became recognized as important. Moved to the PFORT subset of Fortran 66 and later to Fortran 77.
- 1988 Harwell Sparse Matrix Library marketed by NAG.
- Moved from single subroutines to packages of subroutines.

HSL at RAL, 1990-2000

- With the move to RAL, we switched to 2-yearly releases, starting with HSL 10 in Fortran 77, with IBM assembler routines removed.
- Difficult relationship with Harwell who owned most of HSL. Frequent change of personnel, with no expertise in numerical software.
- 1995. Second release of Harwell Sparse Matrix Library (45 packages).
- 1995. Began to include Fortran 90 routines.
- 1996. Main funding source EPSRC research grant instead of SLA.
- 2000. Lawrence Daniels of Hyprotech took over on the Harwell side with enthusiasm and real understanding. Great relief!

2000-2014

- 2000. HSL 2000 and HSL Archive. Moved older packages, superseded by newer versions (but still in user codes) into HSL Archive, with little restrictions on use.
- 2000. Began to include parallel programming using MPI.
- HSL 2002. Free download for UK academics for teaching and research.
- 2007. Lawrence Daniels died of cancer. We lost our champion in AspenTech who had taken over HyproTech. Much missed!
- 2009. Began to include parallel programming using OpenMP.
- 2010. Free download for any academic for teaching and research.
- 2011. Began to provide Matlab and C interfaces to key routines.

HSL now – HSL 2013

- A specialist collection of over 130 state-of-the-art packages for large-scale scientific computation.
- A high standard of reliability and has an international reputation as a source of robust and efficient numerical software.
- Its best known packages are those for the solution of sparse linear systems of equations and sparse eigenvalue problems.
- Over last 3 years, downloaded by more than 2000 academics from 68 countries.
- Used in a huge variety of applications.