Fortran Resources[1]

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[1]The original basis for this document was Mike Metcalf's Fortran Information File. The next input came from people on comp-fortran-90. Details of how to subscribe or browse this list can be found in this document. If you have any corrections, additions, suggestions etc to make please contact us and we will endeavor to include your comments in later versions. Thanks to all the people who have contributed.

Contents

Chapter 1

Fortran 90, 95, 2003 and 2008 Books

Version 1.6, January 2012; Added Section 1.5 Chivers;

Version 1.5, October 2011; Added Section 1.1 Chivers; Added Section 1.1 Clerman; Added Section 1.1 Gnu Fortran; Added Section 1.1 Rouson Added Section 1.2 Lakshmivarahan;

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Version 1.3, June 2009; Removed invalid web address in Morgan and Schonfelder entry; Corrected spelling in Chinese entry;

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Version 1.1, September 2007; Added Section 1.1, Chapman; Added Section 1.2, Lemmon;

1.1 Fortran 2003 and 2008 - English

- Adams, J.C., Brainerd, W.S., Hendrickson, R.A., Maine, R.E., Martin, J.T., Smith, B.T., The Fortran 2003 Handbook, The Complete Syntax, Features and Procedures, 2008, Springer Verlag, ISBN: 978-1-84628-378-9

- Brainerd, W.S., Guide to Fortran 2003 Programming, 2009, Springer Verlag, ISBN 978-1-84882-542-0

- Chapman S.J., Fortran 95/2003 For Scientists and Engineers, 2007, McGraw-Hill. ISBN 978-0073191577, ISBN 0073191574

- Chivers I.D., Sleightholme J., Introduction to Programming with Fortran: With coverage of Fortran 90, 95, 2003, 2008 and 77, 2012, Springer Verlag. ISBN-10: 0857292323 ISBN-13: 978-0857292322

- Clerman N.S., Spector W., Modern Fortran: Style and Usage Cambridge University Press, 2011. ISBN-10: 052173052X ISBN-13: 978-0521730525

- Gnu Fortran Team, Using Gnu Fortran: Manual For Gcc Version 4.3.3, CreateSpace. ISBN-10: 1441412662 ISBN-13: 978-1441412669, 2009

- McCormack D., Scientific Software Development with Fortran, 2009, ISBN 978-1-4452-5445-6

- Metcalf M., Reid J. and Cohen M., Fortran 95/2003 Explained, 2004, Oxford University Press. ISBN 0-19-852693-8, ISBN 0-19-852692-X

- Ray S., A Textbook on Fortran 2003, 2009, Alpha Science International, ISBN 978-1-84265-479-8

- Rouson D., Xia J., Xu X., Scientific Software Design: The Object-Oriented Way Cambridge University Press, 2011. ISBN-10: 0521888131 ISBN-13: 978-0521888134

1.2 Fortran 95 - English

- Adams J.C., Brainerd W.S., Martin J.T,, Smith B.T., and Wagener J.L, Fortran 95 Handbook, 1997, MIT. ISBN 0-262-51096-0.

- Adams J.C., Brainerd W.S., Martin J.T.and Smith B.T., Fortran Top 95, Ninety Five Key Features of Fortran 95, $10 The book is only available in PDF form from the Fortran Store, http://www.fortran.com/

- Akin E., Object Oriented Programming via Fortran 90/95, 2003, Cambridge University Press. ISBN 0-521-52408-3.

- Chapman S. J., Fortran 90/95 for Scientists and Engineers, 2004, McGraw Hill. ISBN 0-07-282575-8.

- Chapman S.J., Introduction to Fortran 90/95, 1997 McGraw-Hill, 1997, ISBN 0-07-011969-4.

- Chivers I.D., Sleightholme J., Introduction to Programming with Fortran: With coverage of Fortran 90, 95, 2003 and 77, 2006, Springer Verlag. ISBN 1-84628-053-2.

- Chivers I.D., Sleightholme J., Introducing Fortran 95, 2000, Springer Verlag. ISBN 185233276X
- Counihan M., Fortran 95, 1997, UCL. ISBN 185728367-8.
- Etzel M., Dickinson K., Digital Visual Fortran 90 Programmer's Guide, 1999, Digital Press. ISBN 1-55558-218-4.
- Gehrke, Fortran 95 Language Guide, 1996, Springer ISBN 3-540-76062-8.
- Lakshmivarahan S., Sudarshan K. Dhall, Programming in Fortran 90/95, Publisher: Pearson Custom Publishing (2002) ASIN: B000XM3WZ0
- Lawrence N., Compaq Visual Fortran: A Guide to Creating Windows Applications, 2001, Digital Press. ISBN 1-55558-249-4.
- Lemmon D.R.,Schafer J.L., Developing Statistical Software in Fortran 95, 2005, Springer. ISBN-10 0387238174 ISBN-13 978-0387238173.
- Metcalf M., Reid J., Fortran 90/95 Explained, 1999 Oxford University Press. ISBN 0-19-850558-2
- Morgan & Schonfelder, Programming in Fortran 90/95, available in Acrobat PDF format from http://www.fortran.com/
- Rajaram V., Computer Programming in Fortran 90 and 95, 2004, Prentice Hall, ISBN 978-8120311817
- Vowels R., Introduction to Fortran 90/95, Algorithms, and Structured Programming, Part 1: Introduction to Fortran 90, Part 2: Algorithms and Fortran 90. ISBN 0-9596384-8-2.

1.3 Fortran 90 - English

- Barlow R.J., Barnett A.R., Computing for Scientists: Principles of Programming with Fortran 90 and C++, 1998, Wiley Blackwell, ISBN 978-0471955962
- Adams, Brainerd, Martin, Smith and Wagener, Fortran 90 Handbook, 1992, McGraw Hill. ISBN 0-07-000406-4.
- Brainerd, Goldberg and Adams., Programmers Guide to Fortran 90, 1996, Springer ISBN 0-387-94570-9.
- Brainerd, Goldberg and Adams., Programmers Guide to Fortran 90, 1994, Unicomp. ISBN 0-07-000248-7
- Brooks ., Problem solving with Fortran 90: for scientists and engineers, 1997, Springer. ISBN 0-387-98229-9.

- Chivers I.D., Sleightholme J., Introducing Fortran 90, 1995, Springer. ISBN 3-540-19940-3
- Ellis, Philips, Lahey, Fortran 90 Programming, 1994, Addison Wesley, ISBN 0-201-54446-6.
- Etter ., Fortran 90 for Engineers, 1995, Benjamin/Cummings ISBN 0-201544-46-6.
- Gehrke, Fortran 90 Language Guide, 1996, Springer ISBN 3-540-19926-8
- Hahn D.B., Fortran 90 for Scientists and Engineers, 1994, Edward Arnold ISBN 0-340-60034-9.
- Huddleston ., Fortran 90, 1996, Exchange Publ. Div., ISBN 0-945261-07-1.
- Kerrigan J.F., Migrating to Fortran 90, 1993, O'Reilly. ISBN 1-56592-049-X
- Meissner L.P., Fortran 90, 1995, PWS Kent ISBN 0-534-93372-6.
- Metcalf M., Reid J., Fortran 90 Explained, 1990 Oxford University Press, ISBN 0-19-853772-7
- Morgan & Schonfelder, Programming in Fortran 90, 1993, Alfe4d Waller. ISBN 1-872474-06-3
- Nyhoff ., Leestma ., Fortran 90 for Engineers and Scientists1, 1996, Prentice Hall, ISBN 0-13-519729-5.
- Nyhoff ., Leestma ., An introduction to Fortran 90 for Engineers and Scientists, 1996, Prentice Hall, ISBN 0-13-505215-7.
- Redwine ., Upgrading to Fortran 90, 1995, Springer-Verlag, ISBN 0-387-97995-6.
- Schick ., Silverman ., Fortran 90 and Engineering Computation, 1994, John Wiley, ISBN 0-471-58512-2.
- Smith I.M., Programming in Fortran 90, ?, Wiley ISBN 0471-94185-9.
- Wagener ., Fortran 90 Concise Reference, 1998, Absoft. ISBN 0-9670066-0-0.

1.4 English books on related topics

- Advanced Scientific Computing - Wille, Wiley, 1995, ISBN 0471-95383-0.
- Atlas for Computing Mathematical Functions ... in Fortran 90 and Mathematica - Thompson, Wiley, 1997, 0-471-18171-4.

- Contemporary Computing for Technical Engineers and Scientists: using Fortran 90 and spreadsheets - Forsythe, PWS, 1997, 0-534-93139-1.

- Numerical Recipes in Fortran 90: The Art of Parallel Scientific Computing, Volume 2 of Fortran Numerical Recipes - Press, Teukolsky, Vetterling and Flannery, Cambridge U. Press, ISBN 0-521-57439-0, 1996. Code can be downloaded (purchased) from http://www.nr.com/. A CDROM is also available (see Web site).

- Parallel Programming in OpenMP, Chandra et al, 2007, Morgan Kaufmann, ISBN 978-1-55860-671-5

- Using OpenMP, Chapman et al, 2007, MIT Press, ISBN 978-0262533027

1.5 Chinese

- Introduction to Programming with Fortran, with coverage of Fortran 90, 95, 2003 and 77. Ian Chivers and Jane Sleightholme. Posts and Telecom Press and Springer-Verlag London. 2009. ISBN 978-7-115-21227-6. (A translation of Introduction to Programming in Fortran).

- Programming Language Fortran 90 - He Xingui, Xu Zuyuan, Wu Qingbao and Chen Ming yuan, China Railway Publishing House, Beijing, ISBN 7-113-01788-6/TP.187, 1994.

- Fortran 90 - Walter S. Brainerd, Charles H. Goldberg, Jeanne C. Adams, CHEP, Beijing, and Springer, Berlin, 2000, ISBN 7-04-007937-2 (a translation of Programmer's Guide to Fortran 90).

1.6 Dutch

- Fortran 90 - W.S. Brainerd, Ch.H. Goldberg, and J.C. Adams, translated by J.M. den Haan, Academic Service, 1991, ISBN 90 6233 722 8.

1.7 Finnish

- Fortran 90/95 - Juha Haataja, Jussi Rahola and Juha Ruokolainen. Center for Scientific Computing (Finland), 2001, 339 pages, 3rd edition, ISBN 952-9821-60-3. WWW version: http://www.csc.fi/oppaat/f95/

1.8 French

- Fortran 90; Approche par la Pratique - P. Lignelet, Srie Informatique ditions, Menton, 1993, ISBN 2-909615-01-4.

- Fortran 90. Les concepts fondamentaux, the translation of Fortran 90 Explained, M. Metcalf, J. Reid, translated by M. Caillat and B. Pichon, AFNOR, 1993, Paris, ISBN 2-12-486513-7.
- Fortran 90; Initiation partir du Fortran 77 - Aberti, Srie Informatique ditions, Menton, 1992, ISBN 2-909615-00-6.
- Les spcificits du Fortran 90, M. Dubesset et J. Vignes, ditions Technip, 1993 . ISBN 2-7108-0652-5.
- Manuel complet du langage Fortran 90, et guide dapplication, P. Lignelet, Srie Informatique ditions, 1995. ISBN 2-909615-02-2.
- Manuel Complet du Langage Fortran 90 et Fortran 95, Calcul intensif et Gnie Logiciel, P. Lignelet, Masson ditions, Paris, 1996, ISBN 2-225-85229-4.
- Programmer en Fortran 90, C. Delannoy, Eyrolles, 1992, ISBN 2-212-08723-3.
- Traitement des donnes numriques avec Fortran 90, M. Olagnon, Masson ditions, 1996, ISBN 2-225-85259-6.
- Structures des donnes (et leurs algorithmes) en Fortran 90/95, P. Lignelet, Masson ditions, Paris, ISBN 2-225-85373-8.

1.9 German

- Fortran 90 Lehrbuch D. Rabenstein, Hanser, 1995, ISBN 3-446-18235-7.
- Die Programmiersprache F W. Gehrke, Springer-Verlag, ISBN 3-540-63376-6.
- Fortran 90 - B.Wojcieszynski and R.Wojcieszynski, Addison-Wesley, 1993, ISBN 3-89319-600-5.
- Fortran 90: eine informelle Einfhrung M. Heisterkamp, BI-Wissenschaftsverlag, 1991, ISBN 3-411-15321-0.
- Fortran 90 Kurs: technisch orientiert - G. Schmitt, Oldenbourg, 1996, ISBN 3-486-23896-5
- Fortran 90, Lehr- und Arbeitsbuch fr das erfolgreiche Programmieren, W.S. Brainerd, C.H. Goldberg, and J.C. Adams, translated by Peter Thomas and Klaus G. Paul, R. Olbenbourg Verlag, Muenchen, 1994, ISBN 3-486-22102-7.
- Fortran 90 Lehr- und Handbuch - T. Michel, BI-Wissenschaftsverlag, 1994.
- Fortran 90 Referenz-Handbuch: der neue Fortran-Standard W. Gehrke, Carl Hansen Verlag, 1991, ISBN3-446-16321-2.
- Programmierung in Fortran 90 - Schobert, Oldenburg, 1991.

- Programmierung mit Fortran 90 - Bumer, Vieweg, Braunschweig, 1997, ISBN 3-528-05208-2.
- Programmieren in Fortran - Erasmus Langer, Springer-Verlag, Wien New York, 1993. ISBN 3-211-82446-4, 0-387-82446-4.
- Software Entwicklung in Fortran 90 - berhuber and Meditz, Springer Verlag, 1993, ISBN 0-387-82450-2.

1.10 Italian

- Some resources in Italian, including a manual, are at
  http://space.tin.it/computer/gciabu.
- Programmare con Fortran, G. Ciaburro, FAG, 2008, ISBN 9788882336882, www.ciaburro.it/f90/libro.htm, http://www.ibs.it/code/9788882336882/ciaburro-giuseppe/programmare-con-fortran.html

1.11 Japanese

- Fortran 90 Explained - Metcalf and Reid, translated by H. Nisimura, H. Wada, K. Nishimura, M. Takata, Kyoritsu Shuppan Co., Ltd., 1993, ISSN 0385-6984.

1.12 Russian

- An Explanation of the Fortran 90 Programming Language (translation of Fortran 90 Explained - Metcalf and Reid), translated P. Gorbounov, Mir, Moscow, 1995, ISBN 5-03-001426-8. Available also from Petr.Gorbounov@cern.ch.
- FORTRAN 77 to Fortran 90 Tutorial - Einarsson and Shokin, Russian Academy of Sciences, Novosibirsk, 1995, ISBN 5-85826-013-6.

1.13 Swedish

- Fortran 90 - en introduktion - Blom, Studentlitteratur, Lund, 1994, ISBN 91-44-47881-X.

Chapter 2

Fortran 90, 95 and 2003 Compilers

Version 1.9, November 2010. Updated Absoft in response to an email from Wood Lotz.

Version 1.8, July 2010. Updated Sun to reflect takeover by Oracle. Updated Salford to reflect Silverfrost rebranding.

Version 1.7, June 2009. Updated the Cray and Intel entries. Added a new section on compilers that are no longer available. This has involved moving the entries on Apogee, Compaq and NA Software into this section. For historical completeness we've also added an entry for EPC to this section.

Version 1.6, September 2008. Updated the NAG entry with more details of the Fortran Builder IDE.

Version 1.5, September 2007. Updated Absoft Entry, Compaq, Fortran Company, Fujitsu, Gnu Fortran 95, G95, IBM, Intel, Lahey/Fujitsu, NAG, NA Software, NEC, Pathscale, PGI, Salford/Silverfrost, SGI, Sun.

2.1 Introduction

The following is a list of companies and organisations that provide Fortran compilers that conform to the Fortran 90, 95 or 2003 standard. Fortran Forum has a more or less standing table on compilers that support features from the 2003 and 2008 standards. The gfortran, g95 and Sun compilers are free for Linux, and gfortran and g95 are free for Windows.

2.2 Absoft

`http://www.absoft.com/`

Absoft Pro Fortran is a complete tool suite designed to automate building parallel code on Linux, Windows or Mac OS/Intel. Absoft Rolls are also available for x64/Linux. Compilers are full F95, include all popular legacy extensions, many from F2003 and are fully link and debug compatible with the host (Linux, Microsoft, Mac

OS) tool chain. Compilers offer automatic parallelization, vectorization, OpenMP 3.0, GPU support, and Absoft application performance is consistently rated 1 on AMD and Intel systems by third party benchmarks. IDE includes SMP graphical analyzer, Fx3 graphical multi-language debugger, programmers editor, several Fortran specific features, OpenMP and MPI controls, math libraries, VAX/Unix libraries and 2D/3D graphics. Same look, feel and functionality on all systems. Nothing else to buy or learn! IMSL numerical libraries are a bundle option on all platforms.

2.3 Cray

`http://www.cray.com/`

Cray has a fully optimizing Fortran 2003 compiler available for the Cray XT series systems. This compiler also supports OpenMP and several Fortran 2008 features, including submodules and coarrays.

Cray has a fully-optimizing Fortran 95 compiler available for the Cray PVP (J90, SV1), T3E, and X1 systems. The PVP compiler supports automatic parallization and OpenMP. The T3E compiler supports coarrays. The X1 compiler supports automatic streaming, OpenMP, coarrays, and many Fortran 2003 features."

2.4 Fortran Company

`http://www.fortran.com/`

The Fortran Company offers F, the subset language, for Unix and Windows, some in highly optimizing versions. All of the full professional versions of the F compiler are available free by downloading them from the F anonymous ftp directory.

The Fortran Tools include a Fortran 95 compiler with a graphical user interface that runs on Linux or Windows on a CD. The CD also includes several Fortran books in PDF format and many tools, such as Matran, a matrix computation library that uses the highly tuned Atlas libraries, a plotting package, and a library of routines to create GUIs for your Fortran application programs.

2.5 Fujitsu

`http://www.fujitsu.com/global/`

Fortran 95 (Solaris) A powerful, updated development system used for FORTRAN productive applications Current version: Sun Studio 9

The ISO Fortran 95 Standard is fully supported, additionally there are enhancements for Fortran77 such as pointers/structures, binary/octal/hexadecimal constants, etc. High optimization includes automatic parallelization and OpenMP support. A Fortran runtime system optimized for UltraSPARC is now also included in the package. The development environment consists of the following components:

Workbench: An integral development environment for the C/C++ and Fortran compilers, for compiler control, program execution, debugging, performance analysis, coverage etc. with a Motif-based graphical user interface (GUI).

Visual Analyzer: A development and migration tool for C/C++ and Fortran programs. The enclosed Source Analyzer allows the static program structure and the global data relations to be visualized. It contains a class browser, cross references and a calling graph viewer.

Parallel Analyser: Consists of an integrated development environment for the OpenMP programming. It contains a manager, a debugger and a profiler.

Fujitsu also has a Fortran 95 compiler for Linux and a highly optimized, native Fortran 95 compiler, Fortran/VPP and HPF, for its VPP supercomputers.

2.6 Gnu Fortran 95

`http://gcc.gnu.org/wiki/GFortran`

`http://gcc.gnu.org/fortran/`

Gfortran is the name of the GNU Fortran project, developing a free Fortran 95/2003 compiler for GCC, the GNU Compiler Collection. The gfortran development effort uses an open development environment in order to attract a larger team of developers and to ensure that gfortran can work on multiple architectures and diverse environments. The GNU Fortran 95 project, or gfortran, is developing a Fortran 95 compiler front end, as well as runtime libraries, for GCC, the GNU Compiler Collection. Gfortran development is a part of the GNU project, aiming to bring free number crunching to all GNU system variants. The gfortran development effort uses an open development environment in order to attract a larger team of developers and to ensure that gfortran can work on multiple architectures and diverse environments. In particular, the project wishes to reach the users of the Fortran 95 language, be it in the scientific community, in education or in a commercial environment. Today, truly free Fortran 90 or Fortran 95 compilers do not exist. We are trying to make one available to the Fortran community.

2.7 G95

`http://www.g95.org/`

G95 is a stable, production Fortran 95 compiler available for multiple cpu architectures and operating systems. Innovations and optimizations continue to be worked on. Parts of the F2003 standard have been implemented in g95.

2.8 Hewlett Packard

The web address that describes all of the compilers and supported hardware and operating systems is

http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,6235,00.html

HP's Fortran products are available for multiple platforms: Windows, Tru64 UNIX AlphaServer systems, Linux AlphaServer systems, and HP OpenVMS (Alpha / VAX).

Visual Fortran for Windows
Fortran for Linux Alpha
Fortran for Tru64 UNIX Alpha
Fortran for HP OpenVMS Alpha
Fortran for HP OpenVMS Integrity
Fortran for HP OpenVMS VAX
Fortran for HP-UX

The Windows product, Compaq Visual Fortran, includes the Microsoft Developer Studio IDE which can be shared with Microsoft Visual C++. Parallel execution using OpenMP-directed decomposition or HPF is included on the Tru64 UNIX platform. On Windows NT, SMP parallel execution using directed decomposition is available through Visual. Compaq Fortran for Linux Alpha Systems is available as a free download under a Technology Enthusiast license for non-commercial use. All Compaq Fortran 95 products include the Compaq Extended Math Library of optimized scientific subroutines and the allocatable array extensions.

2.9 IBM

http://www-306.ibm.com/software/awdtools/fortran/

http://www-306.ibm.com/software/awdtools/fortran/xlfortran/features/f2003.html

XL Fortran Enterprise Edition for AIX XL Fortran Enterprise Edition for AIX provides industry-leading code optimization and tuning features, a full implementation of the OpenMP API Version 2.5, Symmetric Multiprocessing (SMP) APIs, direct manipulation of the floating-point status and control register, 64-bit enablement, asynchronous I/O, debug memory routines, and many other features.

XL Fortran Advanced Edition for Blue Gene XL Fortran Advanced Edition for Blue Gene is the latest addition to our XL Fortran compiler family. It expands our proven XL Fortarn compiler technology to exploit the capabilities of the PowerPC 440 and 440d processors used in IBM Blue Gene/L supercomputers.

XL Fortran Advanced Edition for Linux XL Fortran Advanced Edition for Linux supports your choice of RHEL4, SLES9, and Y-HPC Linux distributions. Advanced optimization technology and VMX support help you create high-performance 32-bit and 64-bit applications that run efficiently on a variety of processor architectures, including IBM's newest POWER5+ and PowerPC 970 processors, and Apple Power Mac G5 and Xserve G5 systems.

VS FORTRAN VS FORTRAN contains features geared to help Fortran programmers develop applications more easily and efficiently, while using the full power of IBM's large systems.

The second web link has details of Fortran 2003 support.

2.10 Intel

`http://software.intel.com/en-us/intel-compilers/`

Intel offers optimizing Fortran compilers for the IA-32, x64 and IA-64 (Intel Itanium) architectures running the Linux, Mac OS X (IA-32 and x64) or Windows operating systems. Intel Fortran is fully compliant with Fortran 95 and supports most of Fortran 2003, as well as many popular extensions. The compiler offers automatic parallelization and vectorization and supports OpenMP 3.0, as well as generating optimized code for the latest Intel processors and compatible non-Intel processors.

On all platforms, the Intel Fortran compiler includes the Intel Math Kernel Library, a library of highly optimized, extensively threaded math routines for science, engineering, and financial applications. The IMSL Fortran Numeric Library 6.0 from Visual Numerics is an option on Windows.

On Windows, the compiler integrates into Microsoft Visual Studio 2003, 2005 or 2008 and includes a self-sufficient Fortran development environment based on Microsoft Visual Studio 2008. The Windows compiler also provides mechanisms to interface Fortran code with the Microsoft COM and .NET environments. Academic and student pricing is available.

2.11 Lahey/Fujitsu

`http://www.lahey.com/`

Lahey/Fujitsu Fortran 95 is produced by the Lahey/Fujitsu alliance. LF95 is available in three Windows configurations: Express, Standard, and PRO, and two Linux configurations: Express and PRO. All configurations feature: VAX, IBM, and POSIX language extensions, allocatable array enhancements, etc. The Windows and Linux Express version is command line only and features the compiler, linker and debugger. PRO for Windows adds a Fortran-smart Windows editor, a debugger, an AUTOMAKE make utility, and an enhanced Winteracter Starter kit (WiSK) for creating true Windows programs with Fortran, and a Coverage Analysis Tool that detects unexecuted code and performs range of operation checking. The PRO is compatible with Visual C++, Visual Basic, and Delphi and also includes Fujitsus SSL2 Math Library and Visual Analyzer (see below). The PRO Linux version offers auto-parallelization, OpenMP compatibility, thread-safe BLAS and LAPACK, WiSK, AUTOMAKE, and Fujitsus SSL2. All products come with free technical support and are available at . Also available is a subset compiler, elf90.

It would appear that the Windows version is no longer under active development. The last update was dated December 2004.

2.12 NAG

`http://www.nag.co.uk/nagware.asp`

The NAG Fortran Compiler, derived from the world's first Fortran 90 Compiler from NAG is robust, highly tested, and valued by developers all over the globe for its checking capabilities and detailed error reporting. Available on a wide range of Unix and Windows platforms it accepts fixed or free format Fortran 95 input and many common Fortran 77 extensions are allowed. A large number of Fortran 2003 language features are now available. HPF code is also compiled and checked though only single processor output is generated.

The following versions are available.
AMD-64_Linux64
Apple_Power_Mac
Free_BSD
HP_Alpha_Linux
HP_Alpha_Tru64
HP_PA-RISC_1.1
IBM_Power_AIX
Intel-32_Windows
Intel-64_Linux64
SGI_MIPS_IRIX
Sun_SPARC_Solaris
x86-32_Linux
An integrated Fortran IDE is also available for Windows.
http://www.nag.co.uk/nagware/np/fortranbuilder.asp

2.13 NEC

`http://www.nec.com/`

NEC has a native, optimizing Fortran 95 compiler, FORTRAN90/SX, with an automatic vectorization and parallelization capability, for its supercomputer SX series. HPF/SX V2 provides functions conforming to the specification of HPF1.1 and HPF2.0 and can be used with vector processing functions in SX Fortran and with parallel processing functions using microtasking.

2.14 PathScale

`http://www.pathscale.com/products/pathscale_compiler_suite`

PathScale's goal is to make it easier to develop and deploy 64-bit applications into clustered environments. PathScale has developed the industry's highest-performance C, C++, and Fortran 9X compilers for 64-bit Linux-based computer systems. The PathScale Compiler Suite shares its heritage with the well-known and mature SGI compiler suite. The PathScale Compiler Suite has been optimized for both the AMD64 and EM64T architectures and has the world's most sophisticated optimization infrastructure.

Unlike other compilers, the PathScale Compiler Suite provides superior performance across both floating-point and integer-intensive applications. Application developers targeting 64-bit Linux servers will see immediate performance benefits from compiling with the PathScale compilers.

The PathScale Compiler Suite includes:

C, C++, and Fortran 77/90/95 compilers Industry leading optimizations Complete support for OpenMP 2.0 (including WORKSHARE) Complete support for 64-bit and 32-bit x86 compilation Code generation for AMD64 ABI, AMD Opteron, and Intel EM64T PathScale optimized AMD Core Math Library (available for download) Advanced serial debugger PathDB Compatible with GNU/gcc tool chain and popular Third Party debuggers Supported on SUSE, RedHat, and Fedora Linux The currently shipping version of the PathScale Compiler Suite is

2.15 PGI

`Http://www.pgroup.com/`

High-performance Optimizing Parallel Compilers

For multi-core 64-bit x64 and 32-bit x86 processor-based Linux, Mac OS X and Windows workstations, servers and clusters.

PGI Workstation includes a single seat license for PGI's suite of compilers and tools. Also available with a multi-user network floating license (PGI Server). The PGI CDK Cluster Development Kit includes all the software for building and programming a turn-key Linux cluster. PGI Visual Fortran fully integrates PGI parallel Fortran into Microsoft Windows using Microsoft Visual Studio 2005.

2.16 Silverfrost, nee Salford Software

`http://www.silverfrost.com/11/ftn95/overview.asp`

Salford Software markets FTN95, a Fortran 95 compiler for Win32, running on Windows 95/NT/2000/XP PCs. It has announced its Fortran 95 compiler for Microsoft .NET (FTN95 for .NET). This compiler will produce fast executables from source files that may be any combination of Fortran 77, Fortran 90 and Fortran 95. FTN95 for .NET, including integrated Help and Debugger, is supplied bundled with FTN95 for Win32 and, optionally, with Microsoft Visual Studio for .NET. A low-cost, fully-featured personal edition is also available.

2.17 SGI

`http://www.sgi.com/products/software/irix/tools/fortran.html`

MIPSpro Fortran Compilers This 64-bit ANSI Fortran 77 compiler is ideal for systems running IRIX 6.x. It is compatible with VAX/VMS Fortran and supports Cray

extensions. The 7.4 version of the MIPSpro Fortran 77 and Fortran 90 compilers now support the OpenMP 2.0 standard. Among the new features introduced in the OpenMP 2.0 specification are:

WORKSHARE directive COPYPRIVATE clause for the broadcast of sequential reads Portable timing routines MIPSpro Fortran 90 Compiler A 64 bit ANSI Fortran 90 compiler with additional support for user-defined multiprocessing directives for systems running IRIX 6.x. Compatible with VAX/VMS Fortran and supports Cray extensions. With the release of version 7.4, Fortran 90 specific support under the OpenMP 2.0 standard are:

Parallelization of F90 array syntax via the WORKSHARE directive Privatization of deferred shape and assumed shape objects The full Fortran 2.0 specification can obtained from the OpenMP Web site at: http://www.openmp.org

For more information, read about the MIPSpro compilers.

2.18 Sun, now Oracle

`http://www.sun.com/`
`http://developers.sun.com/sunstudio/`
`http://developers.sun.com/sunstudio/downloads/express/`

Sun Studio software delivers high-performance, optimizing C, C++, and Fortran compilers for the Solaris OS on SPARC, and both Solaris and Linux on x86/x64 platforms, including the latest multi-core systems.

What's in Sun Studio:

All Compilers - Specify 32-bit or 64-bit Address Model, Auto-parallelization of single-threaded code, Flags, Static data-race and deadlock-detection for x86, Math and Visual Instruction Set Support in SPARC64 VI, Option for Floating-Point, Fused or Multiply-Add Instructions, Option for Thread Analyzer support, Linux Support, OpenMP and OpenMPI suport, Support for the directives, clauses and attributes.

Fortran Compiler - Interval arithmetic support on Solaris Intel platform, Faster compilation time for source files, UNSIGNED arguments, Backward compatibility with f77

C Compiler - More options, Auto-parallelization of single-threaded code, GNU C compatibility

C++ Compiler - More options, ABI compatibility, Compiler flags to optimize for multicore architectures, Static linking the standard C++ runtime library.

2.19 No longer available

2.19.1 Apogee

`http://www.apogee.com/`

Features of the FORTRAN 77/90 Compiler

No longer available. Originally available for the Solaris/SPARC platforms, the compiler conforms to Sun's Solaris ABI and produces assembler code files acceptable to Sun's Solaris assembler. When used in the FORTRAN 77 compilation mode, the compiler is compliant with the MIL-STD 1753 FORTRAN 77 and accepts most FORTRAN 77 extensions of Sun, IBM, and other F77 compilers. The supported F77 extensions include structures, length qualification on types, additional data and constant types, initializations in type statements, additional statements (END DO, DO WHILE, POINTER, VOLATILE, etc.), computations with aggregates, namelist-directed I/Os, and debugging statements.

When used in the Fortran 90 mode, the compiler is compliant with the ANSI/ISO Fortran 90 standard.

2.19.2 Compaq

This compiler is no longer under development. This ceased when Intel bought out the technology from HP. Still widely used with legacy software. Copies for sale can be found on Ebay and similar vites.

2.19.3 EPC

Edinburgh Portable Compilers was an early vendor to produce a Fortran 90 compilation system. A report by Adam Marshall from Liverpool University has a comparision of several early Fortran 90 compilers. It can be found at the address below.

`http://www.liv.ac.uk/HPC/FortranCompilerStudyHTML/FortranCompilerStudyHTML.html`

2.19.4 NA Software

`http://www.nasoftware.co.uk/home.html`

No longer available.

Chapter 3

Fortran aware editors or development environments

Version 1.5, October 2011. Updated photran entry.
Version 1.4, July 2010. Added SunStudio Express entry.
Version 1.31, April 2006. Added Windows Zeus entry.

3.1 Windows

3.1.1 Absoft Editor (ae)

`http://www.absoft.com`

3.1.2 CRiSP

`www.crisp.com` `http://www.crisp.demon.co.uk`

3.1.3 compaq visual fortran 6.x

`No longer available`

3.1.4 editeur

`www.studioware.com`

3.1.5 emacs/xemacs - stand alone

`http://www.gnu.org/software/emacs/emacs.html`

3.1.6 emacs/xemacs - cygwin components

`http://www.cygwin.com/`

3.1.7 gvim/vim - stand alone

`http://www.vim.org/`

3.1.8 gvim/vim - cygwin component

`http://www.cygwin.com/`

3.1.9 jed. wjed (Windows)

`http://www.jedsoft.org/jed/`

3.1.10 lahey ed

`http://www.lahey.com/`

3.1.11 microsoft visual studio 6

No longer available.

3.1.12 Microsoft Visual Studio.NET when one of the following compilers are also installed:

Intel Visual Fortran (www.intel.com) Lahey/Fujitsu Fortran (www.lahey.com) Silverfrost Salford FTN95 (http://www.silverfrost.com/11/ftn95/overview.asp)

3.1.13 nedit - cygwin

`http://www.nedit.org/`

3.1.14 ntemacs

`http://www.gnu.org/software/emacs/windows/ntemacs.html`

3.1.15 photran

`http://www.eclipse.org/photran/`

Photran is an IDE and refactoring tool for Fortran based on Eclipse and the CDT. Photran is a component of the Eclipse Parallel Tools Platform (PTP).

3.1.16 salford plato

`http://www.silverfrost.com/11/ftn95/overview.asp`

3.1.17 Oracle Solaris Studio Express

http://developers.sun.com/sunstudio/downloads/express/

3.1.18 UltraEdit

www.ultraedit.com

3.1.19 xemacs/emacs - stand alone

http://www.gnu.org/software/emacs/emacs.html

3.1.20 xemacs/emacs - cygwin components

http://www.cygwin.com/

3.1.21 Zeus ide

http://www.zeusedit.com/fortran.html

3.2 Linux/Unix

3.2.1 CRiSP

www.crisp.com http://www.crisp.demon.co.uk

3.2.2 emacs/xemacs

http://www.gnu.org/software/emacs/emacs.html

3.2.3 jed, xjed (Unix(all flavours)/OpenVMS) wjed (Windows)

http://www.jedsoft.org/jed/

3.2.4 nedit

http://www.nedit.org/

3.2.5 photran

http://www.eclipse.org/photran/

Photran is an IDE and refactoring tool for Fortran based on Eclipse and the CDT. Photran is a component of the Eclipse Parallel Tools Platform (PTP).

3.3 Apple OS X

3.3.1 Absoft Editor

http://www.absoft.com/

3.3.2 BBEdit

http://www.apple.com/downloads/macosx/productivity_tools/bbedit.html

http://www.barebones.com/products/bbedit/index.shtml

3.3.3 emacs/xemacs

pre-installed

3.3.4 Photran

www.photran.org/

3.3.5 Smultron

http://smultron.sourceforge.net/

3.3.6 TextMate

http://macromates.com/

3.3.7 TextWrangler

http://www.apple.com/downloads/macosx/productivity_tools/textwrangler.html

http://www.barebones.com/products/textwrangler/index.shtml

3.3.8 Vim

Pre-installed

3.3.9 Xcode

http://developer.apple.com/

3.3.10 xemacs/emacs

pre-installed

Chapter 4

Commercial Fortran Courses

Version 1.3, November 2011. Notified by Shaun Forth at Cranfield of their changes. Also added the HECToR entries. Version 1.2, August 2010. Version 1.1, September 2008 Version 1.0, January 2006.

4.1 Ian Chivers and Jane Sleightholme

Ian Chivers and Jane Sleightholme are available to do tailored on site courses. Courses include

- 5 day Introduction to Programming in Fortran 90 and 95
- 3 day Fortran 77 to Fortran 90 and 95 conversion course.
- 3 day crash Fortran 90 and 95 programming course.

See

`http://www.fortranplus.co.uk`

4.2 Cranfield University

Cranfield University offers four Fortran programming courses:

- Introduction to Programming in Fortran 95 (3 days)
- Advanced Programming in Fortran 95 (3 days)
- Fortran 95 for Fortran 77 Programmers (3 days)
- Fortran 2003 for Fortran 95 Programmers (2 days)

These may be taken at the University's Shrivenham Campus or may be delivered at an organisation's site. For more details see

`http://www.cranfield.ac.uk/cds/amsc/fortran.html.`

Additionally, on the HPC front, we run

- High Performance and Parallel Computing (5 days)

`http://www.cranfield.ac.uk/cds/shortcourses/highperfparallelcomputing.html`

which includes MPI up to intermediate level and introductory OpenMP delivered using both Fortran 95 and C. See

`http://www.rmcs.cranfield.ac.uk/amorg`

and follow link to AMORG Short Courses.

4.3 The Fortran Company

`http://www.fortran.com/`

Follow training links.

4.4 Hector

As part of the HECToR project NAG run a number of courses that may be of interest

- Parallel IO
- Parallel Programming with MPI
- OpenMP
- Multicore
- Fortran 95

Contact

`http://www.hector.ac.uk/cse/training/`

for up to date information about dates and more details about the content and duration.

4.5 Lahey

`http://www.lahey.com/`

The Fortran 95 Workshop is a six-session, hands-on, Fortran 95 workshop led by Thomas M. Lahey, CEO, Lahey Computer Systems, Inc.

4.6 Michael Metcalf

formerly of CERN, Switzerland, and an ex-member of J3 and WG5, offers a Fortran 95 course that lasts for six 75-minute sessions. There is an F version too. He is happy to negotiate holding either version anywhere in the world. These courses are suitable for graduates, or equivalent level, and are a useful way to kick-start a Fortran 90/95 or an F activity at a given site. Contact at michael.metcalf@t-online.de, or Manfred-von-Richthofen Strae 15, 12101 Berlin, Germany, +0049.30.78952573.

4.7 Nihon NAG, Numerical Algorithms Group Japan

Offers a Fortran Introduction course and Fortran consultancy. Their top page is

`http://www.nag-j.co.jp/`

They also have online material for their Fortran Introduction course, starting from

`http://www.nag-j.co.jp/fortran/index.html`

4.8 PTR Associates

Currently offer two Fortran courses.

`http://www.ptr.co.uk/fortran-conversion-course.html`

`http://www.ptr.co.uk/fortran-programming.html.`

4.9 Purple Sage Computing Solutions, Inc

is offering three Workshops to Fortran programmers: The Fortran Modernization, Optimization and Parallelization Workshop; The Parallelization for Fortran Programmers Workshop; and The fthreads Workshop. Contact dnagle@erols.com or

`http://users.erols.com/dnagle.`

Also on offer is a one day workshop on the new features of Fortran 2000. See

`http://users.erols.com/dnagle/wsf2000.html`

.

for more details.

4.10 John Reid

formerly of J3 and a member of WG5, offers a Fortran 90 course. He is happy to negotiate holding it anywhere in the world. It is suitable for graduates, or equivalent level, and is a useful way to kick-start a Fortran 90 activity at a given site.

Contact john.reid@stfc.ac.uk.

4.11 France

Simulog, attn. Mr. E. Plestan,
1 rue James Joule, F-78286 Guyancourt Cedex, France
Tel: +33 1 30 12 27 80 fax: +33 1 30 12 27 27
info@simulog.fr

`Web address no longer valid.`
`http://www.simulog.fr/iforef.htm`

4.12 Japan

4.12.1 Nihon NAG, Numerical Algorithms Group Japan

Offers a Fortran Introduction course and Fortran consultancy. Their top page is

`http://www.nag-j.co.jp/`

They also have online material for their Fortran Introduction course, starting from

`http://www.nag-j.co.jp/fortran/index.html`

A Japanese company offering courses and conversion consultancy is SofTek Systems, Inc. (see above).

Chapter 5

Fortran On Line Training Material

Version 1.0 January 2006

5.1 CERN

`http://wwwinfo.cern.ch/asdoc/f90.html`

5.2 Paul Dubois

`http://prdownloads.sourceforge.net/pyfortran/OBF90.zip.`

lecture notes and class materials on Object Based Programming in Fortran 90 (In WinZip, on the Options—Configuration menu, turn off tar smart convert CR/LF.)

5.3 Edinburgh University

`http://www.epcc.ed.ac.uk/training-education/`

Offer a range of courses.

5.4 Linkoping University

`http://www.nsc.liu.se/~boein/f77to90/f77to90.html`

Fortran 77 to 90 Converson Course

5.5 Liverpool University

`http://www.liv.ac.uk/HPC/HPCpage.html`

Covers f90 and HPF, with Java-enhanced Web pages.

5.6 Manchester Computer Centre

No longer available.

5.7 Drew McCormack

`http://www.macanics.net/publications/`

f90 for f77 programmers. It is broken into 3 days 1) Basic intro to f90; 2) Structured programming with f90, using modules and user-defined types to create Abstract Data Types (ADTs) 3) Parallel programming with MPI and OpenMP. The course was written for Chemical Physicists, but a general scientist could follow them.

5.8 French

Support de cours Fortran 90 IDRIS - Corde & Delouis

`www.idris.fr/data/cours/lang/fortran/choix_doc.html`

Chapter 6

Graphics and Windows Programming and Fortran

itemVersion 1.1, June 2009; updated web links.

Version 1.0, January 2006.

6.1 Introduction

This can be broken down into

- Simple graphics programming using a library
- visual interface via raw windows programming
- visual interface via visual development environment

Here are some of the library and development offerings.

6.2 dislin

DISLIN is a high-level plotting library for displaying data as curves, polar plots, bar graphs, pie charts, 3D-color plots, surfaces, contours and maps.

`http://www.mps.mpg.de/dislin/`

documentation

`http://www.mps.mpg.de/dislin/contents.html`

worked examples

`http://www.mps.mpg.de/dislin/examples.html`

6.3 gino

GINO is a suite of high-end development tools for creating complex 2D and 3D graphics and GUI applications. The products are ideally suited for aerospace, defence, utilities and other leading engineering organizations. The GINO products are available for Fortran, C/C++, VB, Delphi and .NET programming environments.

`http://www.gino-graphics.com/home/home.htm`

`http://www.polyhedron.co.uk/`

documentation
The software is supplied with on-line manuals in a variety of formats depending on the environment it is running (Windows Help, HTMLHelp, HTMLHelp2, PDF) and Printed Manuals are available at an additional cost.

`http://www.gino-graphics.com/downloads/manuals.htm`

worked examples

6.4 ginomenu

GINOMENU is a subroutine toolkit for developing GUI applications under Windows. It provides extensive window and widget building modules allowing professional user-interfaces to be created under Windows 9x/NT/2000/XP without the need to get involved in MFC, API or mixed-language programming.

`http://www.gino-graphics.com/products/menu.htm`

`http://www.polyhedron.co.uk/`

documentation
Windows HTML Help, PDF and printed documentation

`http://www.gino-graphics.com/downloads/manuals.htm`

worked examples

6.5 interactor

`http://www.polyhedron.co.uk/`

INTERACTER is our original multi-platform user-interface and graphics subroutine library for Fortran 77/9x developers.
documentation -
worked examples

6.6 opengl

OpenGL is the premier environment for developing portable, interactive 2D and 3D graphics applications. Since its introduction in 1992, OpenGL has become the industry's most widely used and supported 2D and 3D graphics application programming interface (API), bringing thousands of applications to a wide variety of computer platforms. OpenGL fosters innovation and speeds application development by incorporating a broad set of rendering, texture mapping, special effects, and other powerful visualization functions. Developers can leverage the power of OpenGL across all popular desktop and workstation platforms, ensuring wide application deployment.

`http://www.opengl.org/`

documentation

worked examples

f90gl is a public domain implementation of the official Fortran 90 bindings for OpenGL.

`http://math.nist.gov/f90gl/`

Precompiled f90gl libraries are available for some compilers. Lahey LF90, LF95 and ELF90: http://www.lahey.com (search for OpenGL)

Compaq CVF (formerly DVF): http://www.compaq.com/fortran/ (click on "Downloads" and search for f90GL)

Intel Visual Fortran: https://premier.intel.com/ (Registered users log in, select File Downloads and search for f90gl.)

documentation

`http://math.nist.gov/f90gl/documentation.html`

worked examples

Some precompiled libraries may not include the example programs or the source code for the examples. The following files contain the examples subdirectory from the f90gl distribution.

Unix: fglexamp.tar.gz gzipped tar file (73K) Win32: fglexamp.zip zip file (134K)

6.7 psplot

A free Fortran-callable PostScript Plotting Library

`http://www.nova.edu/ocean/psplot.html`

documentation

`http://www.nova.edu/ocean/grman.pdf`

worked examples

6.8 realwin

RealWin lets a Fortran programmer create full-featured applications for Microsoft 32-bit Windows platforms.

`http://www.indowsway.com/home.htm`

`http://www.indowsway.com/`

documentation
worked examples

6.9 toolmaster

`http://www.avs.com/software/soft_t/toolm.html`

Toolmaster agX is a cross-platform graphics library. For FORTRAN programmers, AVS offers FGL/AGL, which provides equivalent functionality to the agX C library.
documentation
worked examples

`http://www.avs.com/software/soft_t/toolm.html`

6.10 winteractor

`http://www.polyhedron.co.uk/`

Winteracter is a modern GUI toolset for the Fortran 90/95 programming language. It consists of various visual development tools and a substantial subroutine library. Versions are available for most Fortran 9x compilers.
documentation
worked examples

6.11 Microsoft Windows graphics programming

This can be done in a variety of ways.

The following is a good book with examples of doing this using Compaq Visual Fortran.

Norman Lawrence, Compaq Visual Fortran: A Guide to Creating Windows Applications.

He also has coverage of opengl.

It is also possible to develop the visual interface using Visual Basic and call fortran dlls.

If you have Compaq Visual Fortran then the on-line Programmers Guide has coverage of mixed language programming with examples.

The following compilers offer intergrated support for Windows programming under .NET.

Lahey/Fujitsu

`http://www.lahey.com/`

PRO for Windows adds a Fortran-smart Windows editor, a debugger, an AUTOMAKE make utility, and an enhanced Winteracter Starter kit (WiSK) for creating true Windows programs with Fortran, and a Coverage Analysis Tool that detects unexecuted code and performs range of operation checking. The PRO is compatible with Visual C++, Visual Basic, and Delphi and also includes Fujitsus SSL2 Math Library and Visual Analyzer (see below).

Salford Software

`http://www.silverfrost.com/11/ftn95/overview.asp`

FTN95 for .NET, including integrated Help and Debugger, is supplied bundled with FTN95 for Win32 and, optionally, with Microsoft Visual Studio for .NET. A low-cost, fully-featured personal edition is also available.

Chapter 7

Parallel Programming with Fortran

Version 1.5, October 2011; Updated gfortran mpi entry; updated Intel coarray entry; updated NAG openmp entry

Version 1.4, August 2010; Updated coarray, mpi and openmp entries.

Version 1.3, July 2010; Added g95 entry. Modified gfortran entry.

Version 1.2, June 2009; Corrected and updated several web addresses.

Version 1.1, January 2006.

7.1 Introduction

The Fortran language has been standardised a number of times

- Fortran 66
- Fortran 77
- Fortran 90
- Fortran 95
- Fortran 2003

and Fortran 2008 will be completed this year (2010).

The Fortran 90 standard added whole array features and a WHERE construct that were aimed at parallel programming.

The Fortran 95 standard added the FORALL construct, and PURE and ELEMENTAL procedures to help with parallel programming.

Fortran 2008 adds coarrays.

Independently of the Fortran Standards Committees there have been a number of other developments aimed at parallel programming including

- HPF
- MPI
- OPENMP
- Posix Threads

and each of these is covered in more depth below.
Two tutorials on parallel programming are given below.

`http://www.mhpcc.edu/training/workshop/parallel_intro/MAIN.html`

`http://users.actcom.co.il/~choo/lupg/tutorials/parallel-programming-theory/parallel-programming-theory.html`

7.2 Automatic

By this is meant automatic parallelisation of the code without source code modification.

7.3 Coarray Fortran

Coarray Fortran is a small extension to Fortran 95. It is a simple, explicit notation for data decomposition, such as that often used in message-passing models, expressed in a natural Fortran-like syntax. The syntax is architecture-independent and may be implemented not only on distributed memory machines but also on shared memory machines and even on clustered machines.

This is a proposal for Fortran 2008.

`ftp://ftp.nag.co.uk/sc22wg5/N1601-N1650/N1642.pdf`

`http://j3-fortran.org/doc/meeting/173/05-208.txt`

Older references can be found at

`http://www.co-array.org/`

and

`http://lacsi.rice.edu/software/caf/`

There is also a wikipedia entry.

`http://en.wikipedia.org/wiki/Co-array_Fortran`

7.4 HPF

The High Performance Fortran Forum (HPFF), a coalition of industry, academic and laboratory representatives, works to define a set of extensions to Fortran 90 known collectively as High Performance Fortran (HPF). HPF extensions provide access to high-performance architecture features while maintaining portability across platforms.

Harvey Richardson has provided a historical perspective on HPF. Visit

`http://www.zeenty.com/HPF/HPF-intro.pdf`

Requires source code modification.

7.5 MPI

MPI is a library specification for message-passing, proposed as a standard by a broadly based committee of vendors, implementors, and users.

`http://www-unix.mcs.anl.gov/mpi/`

`http://www-unix.mcs.anl.gov/mpi/mpich/`

`http://en.wikipedia.org/wiki/Message_Passing_Interface`

7.5.1 Books

- Aoyama, Yukiya; Nakano, Jun (1999) RS/6000 SP: Practical MPI Programming, ITSO. Available as a pdf.

  `http://www.redbooks.ibm.com/abstracts/sg245380.html`

- Gropp, William; Lusk, Ewing; Skjellum, Anthony (1999a). Using MPI, 2nd Edition: Portable Parallel Programming with the Message Passing Interface. Cambridge, MA, USA: MIT Press Scientific And Engineering Computation Series. ISBN 978-0-262-57132-6.

- Pacheco, Peter S. (1997) Parallel Programming with MPI.[1] 500 pp. Morgan Kaufmann ISBN 1558603395.

7.5.2 Courses

- In the UK the Hector service

  `http://www.hector.ac.uk/`

provide various parallel programming courses. Details of their courses can be found at

`http://www.hector.ac.uk/cse/training/`

- Cambridge University provide an MPI Course, offered by Nick Maclaren. See

  `http://www-uxsup.csx.cam.ac.uk/courses/MPI/`

7.5.3 Requirements

Requires the installation of the MPI library (some compiler companies offer a bundle of compiler and MPI library) and source code modification.

7.6 OPENMP

The OpenMP Application Program Interface (API) supports multi-platform shared-memory parallel programming in C/C++ and Fortran on all architectures, including Unix platforms and Windows NT platforms. Jointly defined by a group of major computer hardware and software vendors, OpenMP is a portable, scalable model that gives shared-memory parallel programmers a simple and flexible interface for developing parallel applications for platforms ranging from the desktop to the supercomputer.

`http://www.openmp.org/`

`http://en.wikipedia.org/wiki/OpenMP`

7.6.1 Books

- R. Chandra, R. Menon, L. Dagum, D. Kohr, D. Maydan, J. McDonald, Parallel Programming in OpenMP. Morgan Kaufmann, 2000. ISBN 1558606718
- B. Chapman, G. Jost, R. van der Pas, D.J. Kuck (foreword), Using OpenMP: Portable Shared Memory Parallel Programming. The MIT Press (October 31, 2007). ISBN 0262533022

7.6.2 Courses

- In the UK the Hector service

  `http://www.hector.ac.uk/`

  provide various parallel programming courses. Details of their courses can be found at

  `http://www.hector.ac.uk/cse/training/`

7.6.3 Resources

http://www.openmp.org/wp/resources/

http://www.openmp.org/wp/resources/openmp-compilers

http://www.openmp.org/wp/resources/openmn-specfications/

7.6.4 Requirements

Requires source code modification.

7.7 Posix Threads

Posix Threads is a library specification for multithreading, proposed as a standard by a broadly based committee of vendors, implementors, and users.

http://www.llnl.gov/computing/tutorials/pthreads/

Requires the installation of a threading library. Many operating systems come with a threading library pre-installed.

Also requires source code modification.

http://www.llnl.gov/computing/tutorials/pthreads/

7.8 Notes on the table below

Here is a quote from an email from Bill Long of Cray.

These interchanges took place on comp-fortran-90 at

http://www.jiscmail.ac.uk/lists/comp-fortran-90.html

The archives go back to 1997 and can be searched.

```
BEGIN QUOTE
>>
>>Erik Schnetter wrote:
>>
>>>
>>>Since MPI and threads are implemented as libraries, they work with
>>>every compiler.  They are on a rather low level.  HPF and OpenMP are,
>>>in a way, language extensions that are translated into MPI or threads
>>>by the compiler.
>>>
>>>
>>>
```

```
>>Perhaps a bit simplistic to say "they work with every compiler".
>>Whether MPI or threads (and what kind of threads) work is generally
>>independent of the compiler, but not of the operating system.   HPF,
>>OpenMP, and some forms of automatic parallelization often involve
>>compiler generated calls to library routines, but
>>not necessarily to MPI or POSIX threads library routines.
>>A vendor might opt for something more efficient.
>>
>>For many of the entries in Ian's list, there is an
>>implied combination of compiler, OS, and hardware.
>>For such a combination it is reasonable to talk
>>about support for MPI or pthreads.
>>Perhaps it would be helpful to be more explicit
>>about that combination.  Most of the parallel
>>programming schemes depend on more than just the compiler.
>>
>>Cheers,
>>Bill
>>
END QUOTE
```

Here is a quote from an email from Malcolm Cohen of NAG

```
BEGIN QUOTE
>>
>>Erik Schnetter said:
>>> The IBM Fortran compiler supports Posix threads:
>>
>>As I suspect do most.  Certainly the NAG compiler does.
>>
>>Cheers,
>>--
>>.........................
>>Malcolm Cohen, Nihon NAG, Tokyo, Japan.
>>(malcolm@nag-j.co.jp)
>>
END QUOTE
```

In the light of these comments I've added a 'C' category which means that you will need to check your

- hardware
- operating system version
- compiler version
- MPI version or Posix Threads version

to see if the combination works.

The Y entry normally means that the compiler supplier provide a bundled or fully supported offering.

7.9 Table of compilers and supported parallel options

	Automatic	Co Array	HPF	MPI	OPENMP	Posix Threads
Absoft						
				Y	Y	C
Cray						
PVP	Y			Y	Y	C
T3E		Y		Y		C
X1		Y		Y	Y	C
Fujitsu						
Sparc				C	Y	C
g95						
		Y				
gfortran						
		Y		Y	Y	
HP						
HP-UX				C	Y	C
Tru64 Unix			Y	C	Y	C
Openvms Alpha				C		C
Openvms Integrity				C		C
Openvms VAX				C		C
CVF Windows				C		C
IBM						
XL	Y			C	Y	Y
Intel						
	Y	Y		C	Y	C
Lahey/Fujitsu						
Pro Linux	Y			C	Y	C
NAG						
AMD-64_Linux64				C	Y	C

Apple_Power_Mac				C		C
Free_BSD				C		C
HP_Alpha_Linux				C		C
HP_Alpha_Tru64				C		C
HP_PA-RISC_1.1				C		C
IBM_Power_AIX				C		C
Intel-32_Windows				C		C
Intel-64_Linux64				C		C
SGI_MIPS_IRIX				C		C
Sun_SPARC_Solaris				C		C
x86-32_Linux				C	Y	C
NEC						
SX	Y			C		C
Pathscale						
	Y			Y	Y	C
Portland Group						
	Y		Y	C	Y	C
SGI						
IRIX	Y			C	Y	C
SUN						
	Y			Y	Y	C
	Automatic	Co Array	HPF	MPI	OPENMP	Posix Threads

7.10 Parallelisation Tools

7.10.1 Crescent Bay Software

Offer a range of parallelisation tools.

`http://www.crescentbaysoftware.com/end_user.html`

VAST-F/Parallel (for Fortran) and VAST-C/Parallel (for C), from Crescent Bay Software, are automatic parallelizing preprocessors that can significantly improve the performance of your important applications on shared memory parallel platforms.

`http://www.crescentbaysoftware.com/vast_parallel.html`

VAST/toOpenMP from Crescent Bay Software is a parallelizing optimizer that adds OpenMP directives to Fortran programs. Translated programs have portable parallelism that can execute efficiently on a variety of SMP parallel systems from multi-cpu PCs to Supercomputers.

`http://www.crescentbaysoftware.com/vast_toOpenMP.html`

7.10.2 Parallel Software Products

Offer a tool to help parallelise Fortran 77, Fortran 90 or Fortran 95 code.
Their web address is

`http://www.parallelsp.com/index.htm`

The tool can generate either MPI calls or Openmp calls.

Chapter 8

Fortran Analysis, Conversion, Maintenance and Refactoring Tools

Version 1.2, 2011; Added refactoring as part of title; Add Photran entry;

Version 1.1, June 2009; Added web address for convert; Added web address for for_struct; Updated Nag entry - tools no longer available, being incorporated into the compiler.

Version 1.0, January 2006.

8.1 Refactoring

Wikipedia has a detailed coverage of code refactoring that is a good place to start. Have a look at

`http://en.wikipedia.org/wiki/Code_refactoring`

Here is their first paragraph.

Code refactoring is disciplined technique for restructuring an existing body of code, altering its internal structure without changing its external behavior, undertaken in order to improve some of the nonfunctional attributes of the software. Typically, this is done by applying series of refactorings, each of which is a (usually) tiny change in a computer program's source code that does not modify its functional requirements. Advantages include improved code readability and reduced complexity to improve the maintainability of the source code, as well as a more expressive internal architecture or object model to improve extensibility.

Photran is listed in the Wikipedia entry as a Fortran refactoring tool.

8.2 Convert

Fortran 77 to Fortran 90 converter by Mike Metcalf.

http://www.nag.co.uk/nagware/Examples/convert.f90

8.3 Forcheck

A Fortran analyzer and programming aid.

http://www.forcheck.nl/

8.4 FOR_STRUCT

http://www.cobalt-blue.com/fs/fsmain.htm

Restructures FORTRAN into Clean, Maintainable Code.

8.5 FOR_STUDY

Analyzes and Documents your FORTRAN code.

http://www.cobalt-blue.com/

8.6 Fortran90-lint

For Fortran 90 program analysis

http://www.cleanscape.net/products/downloads/ftpflint.html

8.7 NAGWare Fortran Tools

The tools provide users with the ability to analyse and transform Fortran 77 and Fortran 95 code. They have been withdrawn as an individual product and are being added to the compiler.

http://www.nag.co.uk/

8.8 photran

Photran is an Integrated Development Environment (IDE) for Fortran 77, 90, 95, and 2003 based on Eclipse and the CDT. The project is maintained by the University of Illinois at Urbana-Champaign and IBM.

http://www.eclipse.org/photran/

8.9 plusFORT

Fortran 77 to Fortran 90 converter.

`http://www.polyhedron.com/`

8.10 VAST/77to90

Fortran 77 to Fortran 90 translator

`http://www.crescentbaysoftware.com/vast_77to90.html`

Chapter 9

Fortran Electronic Lists

Version 1.2, November 2011. Expanded comp.lang.fortran entry with more information about usenet.

Version 1.1, January 2006.

9.1 comp-fortran-90

Jiscmail hosted. Restricted to questions about Fortran since the publication of the Fortran 90 standard. Can either browse on-line or subscribe and get postings via email. Postings are archived and go back to 1997.

`http://www.jiscmail.ac.uk/lists/comp-fortran-90.html`

9.2 comp.lang.fortran

Usenet news hosted Fortran list. Covers all aspects of Fortran.

Usenet is a worldwide distributed Internet discussion system. Users read and post messages (called articles or posts, and collectively termed news) to one or more categories, known as newsgroups. Discussions are generally threaded with modern news reader software.

Usenet is distributed amongst a large, changing set of servers that store and forward messages to one another in so-called news feeds. Individual users may read messages from and post messages to a local server operated by their Internet service provider, university, or employer.

Newsreader clients

Newsgroups are typically accessed with special client software that connects to a news server. Newsreader clients are available for all major operating systems.

Web accessible newsgroups

Web front ends to newsgroups mean that many people now no longer need to use download and install or configure a news reader client Google Groups is one such web based front end and web browsers can access Google Groups.

Free usenet news service

http://www.eternal-september.org/

Welcome to news.eternal-september.org news.eternal-september.org is a private project providing free access to text-only Usenet News. The server has a 100MBit connection to several Internet backbones and is integrated into the Usenet via more than 60 peers.

Free access to the news server news.eternal-september.org provides free read and write access to all text newsgroups. It requires a registration that can be done online.

`http://groups.google.co.uk/group/comp.lang.fortran?lnk=lr`
`http://groups.google.ca/group/comp.lang.fortran`

9.3 Compiler specific

Some of the compiler suppliers provide electronic list support. Some provide an email address for technical support.

9.3.1 Absoft

`http://forums.absoft.com/`

`support@absoft.com`

9.3.2 Apogee

`info@apogee.com`

9.3.3 Compaq

9.3.4 Cray

9.3.5 Fortran Company

You can subscribe to an e-mail list by sending e-mail to majordomo@fortran.com with the following in the body of the message:

subscribe f-interest-group@fortran.com

9.3.6 Fujitsu

9.3.7 Gnu Fortran 95

You can reach us at the fortran@gcc.gnu.org mailing list; for details please refer to our mailing lists page.

`http://gcc.gnu.org/lists.html`

9.3.8 G95

`http://groups.google.com/group/gg95`

9.3.9 Hewlett Packard

`vf-support@hp.com`

9.3.10 IBM

Requires registration.

9.3.11 Intel

Requires registration.

`https://premier.intel.com/WhatsNew.aspx`

9.3.12 Lahey Fujitsu

Requires registration.

`http://www.lahey.com/support.htm`

`http://www.laheyforum.com/`

9.3.13 NAG

Requires registration.

`support@nag.co.uk`

9.3.14 NA Software

9.3.15 NEC

http://www.nec.com/global/support/index.html

9.3.16 Pathscale

Requires registration.

http://pathscale.com/support.html

support@pathscale.com

9.3.17 PGI

Various offerings.

http://www.pgroup.com/support/index.htm

9.3.18 Salford Software

Various options.

http://www.silverfrost.com/22/ftn95/support/index.asp

9.3.19 SGI

Various options.

http://www.sgi.com/support/customerservice.html

9.3.20 SUN

http://forums.sun.com/category.jspa?categoryID=113

Chapter 10

Fortran Standard Bodies

Version 1.0, January 2006.

10.1 Introduction

There are two main Fortran standards bodies and these are WG5 and J3. Each is covered in turn below.

10.2 WG5

Their home page is:-

`http://www.nag.co.uk/sc22wg5/`

Their document ftp site is at:-

`ftp://ftp.nag.co.uk/sc22wg5/`

The working draft document is at:-

`ftp://ftp.nag.co.uk/sc22wg5/N1601-N1650/N1601.pdf.gz`

The timetable for next version is at:-

`ftp://ftp.nag.co.uk/sc22wg5/N1551-N1600/N1590.txt`

The new future classification is at:-

`ftp://ftp.nag.co.uk/sc22wg5/N1551-N1600/N1594.txt`

10.3 J3

Their home page is:-

`http://www.j3-fortran.org/`

Their version of the working draft is at:-

`http://www.j3-fortran.org/doc/year/04/04-007.pdf`

Chapter 11

Other Web Links

Version 1.2, June 2009; Updated several web links.

Version 1.1, September 2008

Version 1.0, January 2006

11.1 Fortran History

11.1.1 A brief history of FORTRAN-Fortran

http://www.ibiblio.org/pub/languages/fortran/ch1-1.html

11.1.2 Computer Languages History (preview)

http://www.levenez.com/lang/history.html

11.1.3 Computer Languages History

http://www.levenez.com/lang/

11.1.4 Fortran A few historical details

No longer available.

11.1.5 Open Directory - Fortran Tutorials Fortran 90 and 95

http://www.dmoz.org/Computers/Programming/Languages/Fortran/Tutorials/Fortran_90_and_95/

11.1.6 Open Directory - Fortran

http://dmoz.org/Computers/Programming/Languages/Fortran/

11.1.7 The Fortran (not the foresight) saga

http://www.fortranplus.co.uk/resources/brian_meeks_fortran_saga.pdf

11.2 Computer Arithmetic

11.2.1 What every computer scientist should know about floating point arithmetic

http://www.validlab.com/goldberg/paper.pdf}

11.2.2 IEEE 754r - Wikipedia, the free encyclopedia

http://en.wikipedia.org/wiki/IEEE_754r

11.2.3 IEEE 754 Standard for Binary Floating-Point Arithmetic

http://grouper.ieee.org/groups/754/

11.2.4 IEEE Standard 754 Floating-Point

http://stevehollasch.com/cgindex/coding/ieeefloat.html}

11.2.5 William Kahan

http://www.cs.berkeley.edu/~wkahan/}

11.2.6 IEEE 754 floating-point test software

http://www.math.utah.edu/~beebe/software/ieee/}

11.2.7 Interval FAQ from Alejandro Casares – What machines support IEEE 754

http://www.mscs.mu.edu/~georgec/IFAQ/casares1.html}

11.2.8 Decimal Arithmetic - FAQ 1

http://www2.hursley.ibm.com/decimal/decifaq1.html#emphasis}

11.2.9 General Decimal Arithmetic

http://www2.hursley.ibm.com/decimal/}

11.3 Programming

11.3.1 Calling FORTAN and C from Java

http://www.csharp.com/javacfort.html

11.3.2 CS 267 Applications of Parallel Computers

http://www.cs.berkeley.edu/~yozo/cs267.sp05/

11.3.3 Hillside.net - Design Patterns Book - DP Book

http://hillside.net/patterns/DPBook/DPBook.html

11.3.4 Hillside.net - Design Patterns Book - Source

http://hillside.net/patterns/DPBook/Source.html

11.3.5 Home page of Les Hatton

http://www.leshatton.org/

11.3.6 Parallel Programming - Basic Theory For The Unwary

http://users.actcom.co.il/~choo/lupg/tutorials/parallel-programming-theory/parallel-programming-theory.html

11.3.7 Putting a Java Interface on your C, C++, or Fortran Code

http://www.math.ucla.edu/~anderson/JAVAclass/JavaInterface/JavaInterface.html

11.3.8 Teach Yourself Programming in Ten Years

http://www.norvig.com/21-days.html