

On The Fortran Programming Language

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Abstract—This paper will introduce and give readers a better understanding of the Fortran programming language. A brief discussion of Fortran’s history and purpose will assist in describing its role in the scientific and engineering community. The advantages that Fortran brings to its intended users are numerous even when compared to the C programming language. These advantages will be identified together with the many applications that still benefit from them today.

I. INTRODUCTION

Fortran is a general-purpose programming language that was originally developed by IBM in 1957. Despite the language’s long history and the introduction of more modern programming solutions, Fortran continues to persist today in highly technical research communities. Undoubtedly, Fortran’s longevity has benefitted greatly from software inertia due to the vast amounts of code written in the language over the years. Even so, Fortran’s advantages when compared to other programming languages such as C helps it stay relevant in modern applications over half a century after its creation.

II. DESCRIPTION

Fortran is considered to be one of the first ever high-level programming languages to be developed. It was designed by IBM specifically for mathematical computations in scientific and engineering applications [1]. To further emphasize the language’s intended purpose, Fortran was named as an acronym for Formula Translation. Since FORTRAN 66, the language has gone through many iterations and has continued to evolve into a robust and performance oriented programming language. The development of Fortran continues to be supported by major industry players including IBM, Cray, Intel, NAG, and NVIDIA, with the newest revision of the language being Fortran 2018 [3]. This heavy active support for Fortran coupled with its lengthy history has resulted in a mature language that contains various advantageous features.

Like C, Fortran is a compiled language in which the program must be passed to a compiler before it can be executed. Precompiling the program allows Fortran to generate efficient executable code that runs significantly quicker and with less resources than interpreted programming languages such as Python. Furthermore, Fortran has features such as built-in support for arguments in subroutines, built-in support for complex numbers with real and imaginary components, and support for array section operations that allow scientists and engineers to efficiently manipulate data and perform advanced calculations [4].

III. COMPARISON WITH C

When compared with C, Fortran’s feature set clearly orients the language towards computational efficiency while C is a general-purpose language. The Fortran language has been designed for array-oriented calculations which allows for a simple and natural method of expressing most arithmetic operations over large arrays. Unlike the sole imperative style of C, Fortran also allows code to be written in either imperative, procedural, object-oriented, or functional style for even greater versatility [2]. Moreover, Fortran natively supports parallel programming to split the execution of computational problems between multiple processors in order to decrease the time needed to achieve the solution [3]. The extensive utilization of Fortran over the decades has produced a cornucopia of mature and proven libraries that a scientist or engineer may choose to use over those of C. Although Fortran excels at arithmetic on arrays, C becomes a better programming solution if the task strays beyond that domain.

IV. FORTRAN APPLICATIONS

Fortran was designed for computationally intensive applications and is still present in many systems today. It is commonly implemented for climate science research such as numerical weather and ocean prediction. Computational fluid dynamics and aerodynamics for civil, mechanical, and aerospace engineering are also common applications for the language. Other beneficial applications include applied math, statistics, and finance. Fortran has also been used to benchmark the fastest supercomputers in the world [2].

V. CONCLUSION

Overall, The Fortran programming language continues to persist in numerous modern applications despite its age. The language is constantly evolving with support from the industry to satisfy the needs of scientists and engineers for a computationally oriented programming language. Fortran continues to build on its feature set to maintain relevancy amongst younger competitors such as C. Its occupation of a niche use-case and efforts to improve will likely keep Fortran in use for years to come.

REFERENCES

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