

## 05.01

# History of Interpolation

*After reading this chapter, you should be able to:*

1. *Know the history of Interpolation and its current uses by the HNMI.*

### History

Sir Edmund Whittaker, a professor of Numerical Mathematics at the University of Edinburgh from 1913 to 1923, observed “the most common form of interpolation occurs when we seek data from a table which does not have the exact values we want.” Throughout history, interpolation has been used in one form or another for just about every purpose under the sun.

Speaking of the sun, some of the first surviving evidence of the use of interpolation came from ancient Babylon and Greece. Around 300 BC, they were using not only linear, but also more complex forms of interpolation to predict the positions of the sun, moon, and the planets they knew of. Farmers, timing the planting of their crops, were the primary users of these predictions. Also in Greece sometime around 150 BC, Hipparchus of Rhodes used linear interpolation to construct a “chord function”, which is similar to a sinusoidal function, to compute positions of celestial bodies.

Farther east, Chinese evidence of interpolation dates back to around 600 AD. Liu Zhuo used the equivalent of second order Gregory-Newton interpolation to construct an “Imperial Standard Calendar”. In 625 AD, Indian astronomer and mathematician Brahmagupta introduced a method for second order interpolation of the sine function and, later on, a method for interpolation of unequal-interval data.

Many similar land-based purposes were found for interpolation over the ages, but ocean navigation was found to be one of the most important applications for centuries. Tables of special function values were constructed using numerical methods, and seafarers used certain ones to determine latitude and longitude values. The French government started production on an extensive set of such tables when the metric system was introduced. Ideally, one would want mathematicians to construct a large set of tables due to their proficiency at the subject. However, the primary source of work on the project ended up being hairdressers who had lost their gaudy-wigged customers to the guillotine.

The unfortunate truth about special function tables is that most of them were plagiarized. Since the “computers”, the workers who carried out and recorded the calculations, were prone to making many errors during the creation of these daunting tables,

plagiarism only propagated more errors. Charles Babbage tried to solve this problem with the invention of his “difference engine”, a mechanical computer programmed by the use of punch cards. On the side, Babbage also tried inventing a system that would choose winning horse race numbers, hoping to raise extra money. Although he was not short of funds, his life ran short and never saw the completion of the invention. Over a century and a quarter later, as we plunge into the nano-technology era, Babbage is now considered the grandfather of modern computing.

During the Great Depression, one final burst of manual table-making found its way into the United States. The Works Progress Administration began the Mathematical Tables Project shortly before World War II. As with the French project, the desired “mathematician” workers ended up being unskilled—this time to the point that negative numbers were puzzling. The solution: black pencils for positive numbers and red ones for negative numbers. Having each calculation in this project iterated twice (each by a different person), and extensive proof reading carried out, these tables were “possibly the most accurate ever produced”. Many of them were collected in a book by Milton Abramowitz and Irene Stegun, which is still in worldwide use today. With computers (not the people type, either), tables are no longer manually constructed, but the Australian Government produces life tables which describe mortality rates. Relevant to the life insurance industry and the study of demography, “these tables are extended using modern interpolation methods.” No matter how advanced or extensive, interpolation will always be needed to find values in modern tables due to their nature. Since they aren’t continuous functions, there will be infinitely many missing values.

Two of the methods of interpolation taught at the HNMI are credited to Newton and Lagrange. Newton began his work on the subject in 1675, which “laid the foundation of classical interpolation theory”. In 1795, Lagrange published the interpolation formula now known under his name, despite the fact that Waring had already produced the same formula sixteen years earlier.

### **Bibliography**

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