



**Simposio Internacional: El legado de Alan Turing**  
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## **Alan Turing and the origins of modern Gaussian elimination**

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The solution of a system of linear equations is by far the most important problem in Applied Mathematics. It is important in itself and because it is an intermediate step in many other relevant problems. Gaussian elimination is nowadays the standard method for solving this problem numerically on a computer and it was the first numerical algorithm to be subjected to a rounding error analysis. In 1948, Alan Turing published a remarkable paper on this topic: "Rounding-off errors in matrix processes" (Quart. J. Mech. Appl. Math. 1, 287-308). In this paper, Turing formulated Gaussian elimination as the matrix LU factorization and introduced the "condition number of a matrix", both of them fundamental notions of modern Numerical Analysis. In addition, Turing presented an error analysis of Gaussian elimination that improved previous analyses and deeply influenced the definitive analysis developed by James Wilkinson in 1961. Alan Turing's work on Gaussian elimination appears in a fascinating period for modern Numerical Analysis. Other giants of Mathematics, such as John Von Neumann, Herman Goldstine, and Harold Hotelling were also working in the mid-1940s on Gaussian elimination. The goal of these researchers was to find an efficient and reliable method to solve systems of linear equations in the recently invented "automatic computers". At that time, it was not clear at all whether Gaussian elimination was a right choice or not. The purpose of this talk is to revise, at an introductory level, Alan Turing's contribution to the analysis of Gaussian elimination, its historical context, and its influence on modern Numerical Analysis.

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