A B C : A T A N A S O F F - B E R R Y

COMPUTER

ABC: A Revolução Esquecida da Computação

ABC: A Revolução Esquecida da Computação

John Atanasoff e a Primeira Máquina Digital Eletrônica

Trabalho de curricularização da disciplina

SSC0571 - Computação e Sociedade: Evolução Histórica e Aplicações

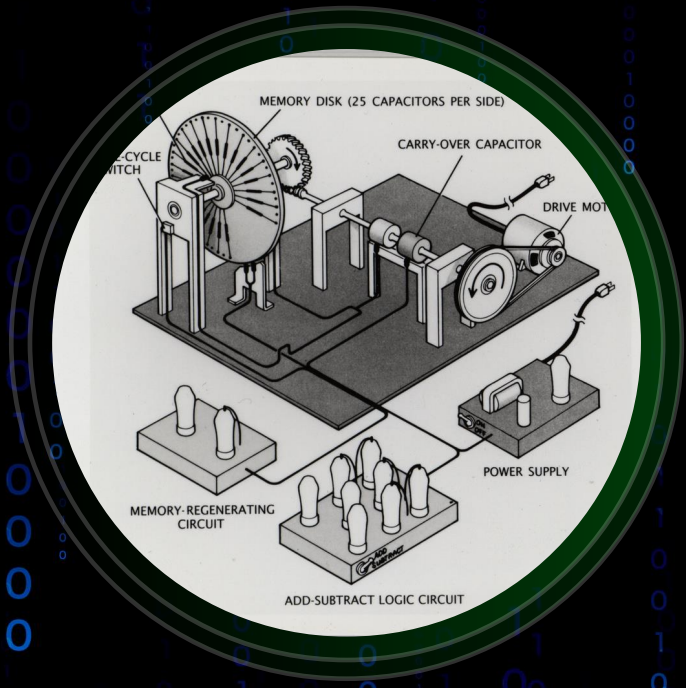
Quem foi John Atanasoff?

1. Físico e matemático (1903–1995) de origem búlgara
2. Professor na Iowa State College (década de 1930)
3. Motivado por resolver sistemas de equações lineares complexas da física (como a polarizabilidade do hélio)
4. Frustração com métodos analógicos existentes na época(réguas de cálculo, máquinas mecânicas)

O Insight em uma Noite de 37

Um Passeio Noturno em Illinois, uma parada em um bar de estrada e uma bebida:
Cinco decisões revolucionárias:

1. **Eletricidade e eletrônica (válvulas termiônicas)**
2. **Contas feitas na base 2 (Sistema binário)**
3. **Memória com capacitores regenerativos(precursor do DRAM)**
4. **Separação entre memória e processamento(futura arquitetura de Von Neumann)**
5. **Cálculo direto (não por enumeração)**

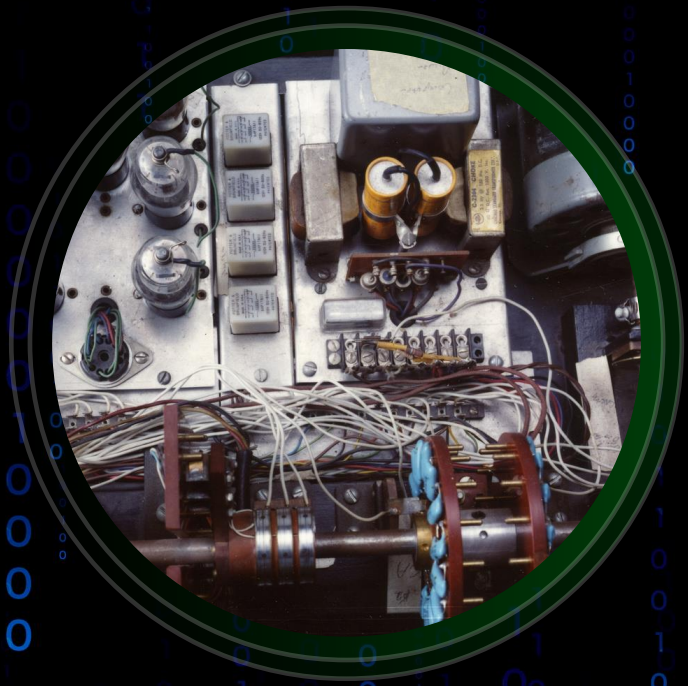


Clifford Berry: O Parceiro Essencial

1. Estudante de engenharia (1918–1963)
2. Habilidades em eletrônica e mecânica
3. Construção do protótipo em 1939(US$ 650 de financiamento)[
4. Parceria descrita por Atanasoff: "Nenhum homem melhor poderia existir"

O ABC em Números

1. Peso: 320 kg | Tamanho: Mesa de escritório:
2. Componentes:
    a. 280 válvulas eletrônicas
    b. Tambor com 30 capacitores (memória regenerativa)
    c. 1,6 km de fios
    d. Velocidade: 30 operações/s (vs. 0,3 do Mark I)[4][15];



Limitações e Parada do Projeto

1. Foco específico: Resolver sistemas de até 29 equações lineares
2. Não programável (diferente do ENIAC)
3. Cartões perfurados problemáticos(erros de leitura)
4. 1942: Atanasoff deixa o projeto para trabalhar na Segunda Guerra

A Guerra das Patentes(1973)

1. ENIAC (1946): Patentado por Mauchly e Eckert, baseado
2. Visita de Mauchly a Atanasoff em 1941: Inspiração não creditada
3. Honeywell vs. Sperry Rand: Tribunal declara o ABC como prior art(design a priori, original)
4. Mauchly derivou ideias de Atanasoff" – Decisão do Juiz Earl R. Larson, após 6 anos

United States Patent Office 3,120,606 Patented Feb. 4, 1964

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3,120,606
ELECTRONIC NUMERICAL INTEGRATOR AND COMPUTER
John Presper Eckert, Jr., and John W. Mauchly, Philadelphia, Pa., assignors, by mesne assignments, to Sperry Rand Corporation, a corporation of Delaware
Filed June 26, 1947, Ser. No. 757,158
48 Claims. (Cl. 235—160)

This invention relates to methods and apparatus for performing computations involving arithmetical operations, at extremely high speeds, and with minimum use of mechanical elements, as generally so termed, and more particularly, relates to the art of electrical computing machines, with particular reference to a machine utilizing electronically produced pulses (i.e., sharp voltage changes not greater than five microseconds in duration) to represent digits and numbers, and using such pulses for control and programming operations, thus obviating the need for mechanically moving parts for these purposes. The present invention also relates to the method of using such pulses for computational purposes.

In the progress of development of computing machines from the time of the use of pebbles or grains, and the application of the abacus, to the extensive mechanical or partly mechanical and partly electrical machines of the present day, the aim has been to remove from the mind of man as much as possible of the responsibility of remembering numbers, remembering the necessary computations to be performed, remembering and writing the results of parts of computations, and how and when to use such results of such parts in complete equations, as well as to effect the necessary operations more rapidly and without physical labor.

The art and technique of aids to computation and calculation have been the subject of extensive development, extending through simple adding machines to present day complex computing machines, which include electric devices, in part in answer to the need and demand for greater speed and the elimination of moving mechanisms whose inertia sets a definite limit to the practicable speed of operation.

With the advent of everyday use of elaborate calculations, speed has become paramount to such a high degree that there is no machine on the market today capable of satisfying the full demand of modern computational methods. The most advanced machines have greatly reduced the time required for arriving at solutions to problems which might have required months or days by older procedures. This advance, however, is not adequate for many problems encountered in modern scientific work and the present invention is intended to reduce to seconds such lengthy computations.

In automatic machines the manner of controlling the storing in memory devices of the necessary numerical components and the "programming" of the pick-up of these numbers and their transfer to particular operating units, as well as the special programming of peculiar internal arithmetic operations in the units, has involved a problem of foremost importance which it is here sought to advance. In such machines it is convenient to designate as "memories" those parts or elements which are so constituted as to predetermine and cause definite effects from signals transmitted to the system. External memories may consist of switches and coupling between units, arbitrarily made in accordance with the planned use of the apparatus for the solution of a given problem, and of means such as tapes or punched cards and reading machines by which numerical data (numbers pulses) and program instructions (characteristic control pulse signals) are introduced into the apparatus. Functions of the machine by which numbers are stored and control pulse signals

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stored for subsequent transmission or collection from storage, as well as any automatically generated or guided to particular units, may be termed internal memories.

It is an especial aim to reduce the requirement of external memories in such machines, and to provide for the replacement thereof by internal memories, so that approach to more fully automatic operation is attained by the mere insertion of data in pulse form and the automatic generation within the machine of the necessary further data, including control pulses.

A machine has been constructed at the University of Pennsylvania which embodies our invention. This machine, hereinafter referred to as ENIAC (from the initials of its name, "Electronic Numerical Integrator and Computer") is the first general purpose automatic electronic digital computing machine known to us. Its speed considerably exceeds that of any non-electronic machine, and its accuracy is in general superior to that of any non-digital machine (such as a differential analyzer).

The ENIAC is extremely flexible, and is not fundamentally restricted to any given class of problems. However, there are problems for which its speed is limited by the input and output devices, so that it is impossible to derive the full benefit of its high computing speed in such cases. The ENIAC carries out its entire computing schedule automatically, but the sequence which it is to follow must be set up manually beforehand. The primary intended use of the ENIAC is to compute large families of solutions all based on the same program of operations, in which case the time spent in manual set-up is relatively unimportant.

It should be noted in this introductory section that it is recognized that the object of computing machine design is not merely to speed up arithmetic processes, but to attain a high overall speed, including the problem set-up and the preparation of results in useful form. It is desirable to have as much as possible done automatically.

It is also to be observed that a great deal of the equipment in non-electronic machines is "in multiple," that is, concurrent operation of many parts is used to increase computing speed. Electronic devices are inherently so fast that it is unnecessary to achieve speed in this way. By resorting to "serial operation," a considerable saving in equipment may be effected. However, the consequent loss in speed is tolerable only when electronic components having high inherent speed are employed. Reliability and maintenance are aided by this equipment reduction, and serial operation also has important advantages both from the point of view of effecting and because it simplifies the work of planning the computational programs.

An examination of the literature of the physical sciences shows that the principal emphasis in these fields has been in the solution of linear problems (those which can be formulated in terms of linear equations) which can be handled by analytic techniques. Physical problems other than those above mentioned are not necessarily more different from a physical science point of view, but they have prior to this invention been by-passed in favor of the problems whose analytic solutions are possible of attainment.

Those problems which cannot be solved analytically have been handled by computational methods or through the use of specific analogy machines. As an illustration of the computational approach we might mention the truly remarkable work of Hartree on the structure of the atom, a series of calculations extending over a period of about 15 years. An exemplification of the latter technique is found in the use of wind tunnels. At present, the supersonic wind tunnel at the Ballistic Research Laboratory, at Aberdeen, Maryland, is used about 30% of the time as

Legado do ABC

1. Reconhecimento póstumo:
   a. Medalha Nacional de Tecnologia (1990)
   b. Ordem de Cirilo e Metódio (Bulgária, 1970)
   c. Influência: Os Princípios do ABC ainda são usados em todos os computadores modernos

"Nenhum homem inventa sozinho; construímos sobre ombros de gigantes" – Atanasoff

OBRIGADO

PELA SUA ATENÇÃO