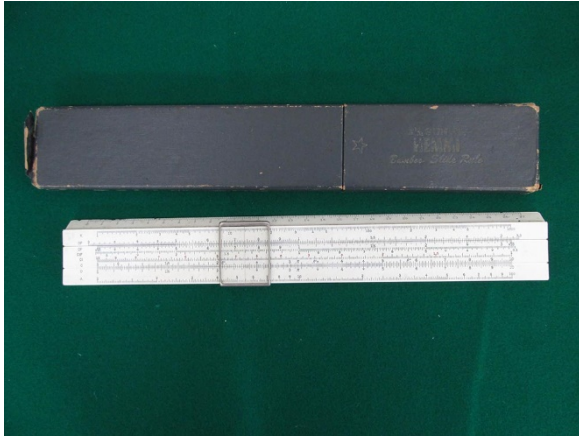


5 Calculator (1) (Analog)



Time and Size can be transformed to equivalent ones which we can imagine using the logarithmic scale.

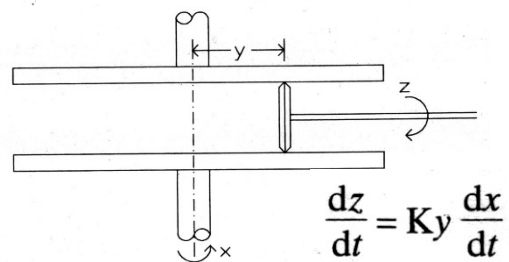
Time Size Equivalence Scale [1]

Banboo Slide Rule[1] ($\log AB = \log A + \log B$)

[1] Donation by Emeritus Prof. Yakichi Higo



Differential Analyzer (<https://www.tus.ac.jp/info/setubi/museu>)



Example of element of mechanical computer (Hermann integrator) (A. Ben Clymer, The mechanical analog computers of Haannibal Ford and William Newell, IEEE Annals of the History of Computing, 15, 2 (1993))

Differential Analyzer is a mechanical analog computer to solve differential equations. It was invented by Prof. V. Bush in MIT in 1931. The machine in the photograph in Tokyo University of Science was used in Shimizu laboratory in the department of mathematics. The principle is an integrator by drawing some area.

Analog computer using operational amplifiers is an electronic computer to solve differential equations. Motion equation is $f = m \frac{d^2 y}{dt^2}$ (f : force, m : mass and y : displacement). By combining integrator as shown in the figure and gravity force (f) is applied at the input, speed (dy/dx) is obtained as a negative value of the output of the 1st stage. Further displacement (y) is obtained at the output of the 2nd integrator. The mass (m) is given by the $C_1 R_1$. When S_1 and S_2 are closed the initial speed is set as E_1 on C_1 , and initial position E_2 on C_2 respectively. S_1 and S_2 are opened at $t=0$ and then the time dependent speed and displacement are given.

