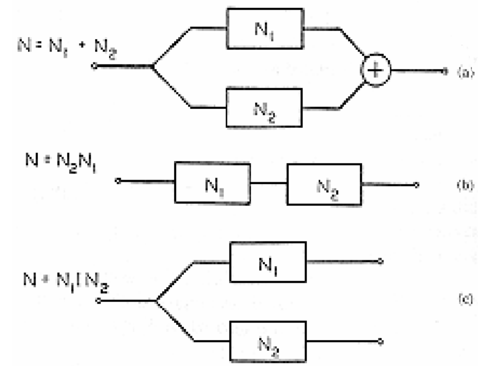
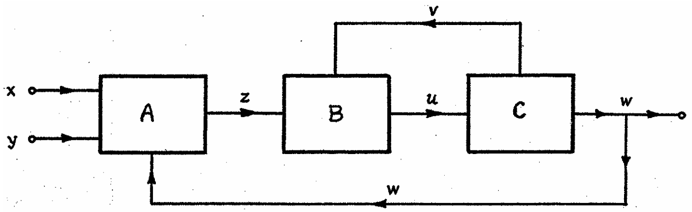
Fuzzy Set Theorie

2. From Circuit Theory to System Theory

Siebschaltungen, Filter



Zadeh, 1949 ff: System Theory



Zadeh, 1949 ff: System Theory

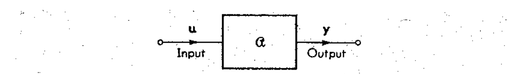


Fig. 1.2.1 Diagrammatic representation of a system α with input u and output y.

Input-output-Beziehung: $y = f(u)$

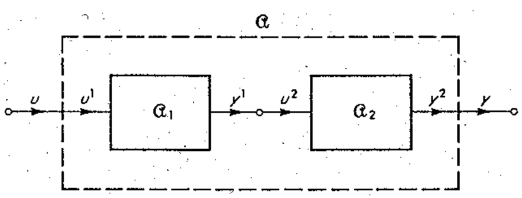


Fig. 1.4.1 Tandem combination of α_1 and α_2.

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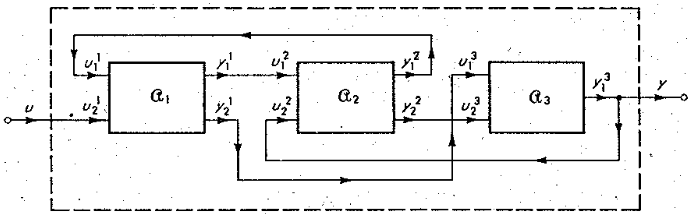

Fig. 1.4.2 Example of a system which is a combination of three component systems $\mathfrak{A}_1$, $\mathfrak{A}_2$, and $\mathfrak{A}_3$.

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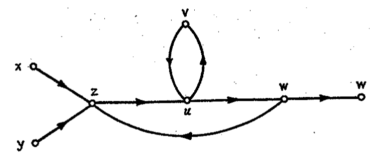


(b)
Fig. 2b

	u	v	w	x	y	z
u	0	1	1	0	0	0
v	1	0	0	0	0	0
w	0	0	0	0	0	1
x	0	0	0	0	0	1
y	0	0	0	0	0	1
z	1	0	0	0	0	0

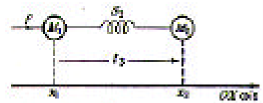


Fig. 1.2.1 Example of a system.

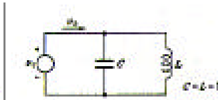


Fig. 1.4.1 A network realization of the object of Example 1.4.14.

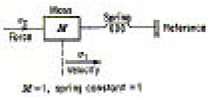


Fig. 1.4.2 A mechanical realization of the object of Example 1.4.14.

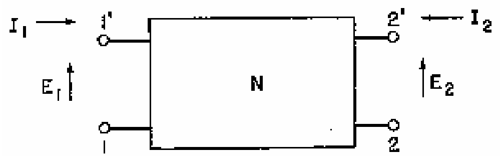


Fig. 1

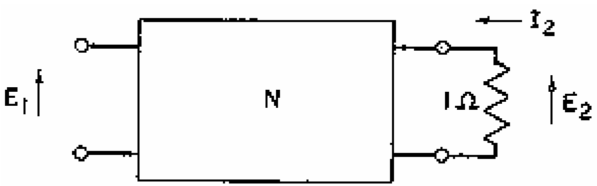


Fig. 2

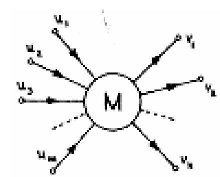


FIGURE 1
Diagrammatic representation of an $m + n$-pole.

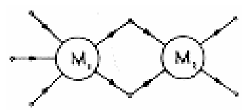


FIGURE 3
The product of M_2 and M_1.

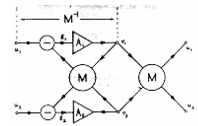


FIGURE 4
Realization of the inverse of M.

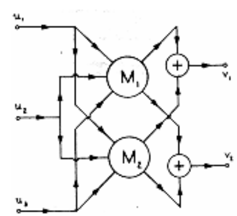


FIGURE 2
The sum of M_1 and M_2.

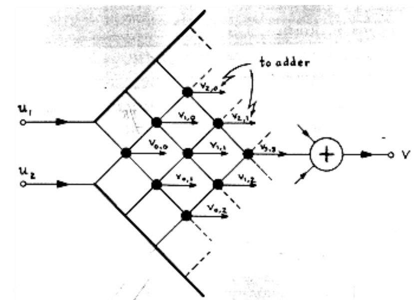


FIGURE 5
Approximate realization of a three-pole of class $\mathfrak{N}_{1,2}$.

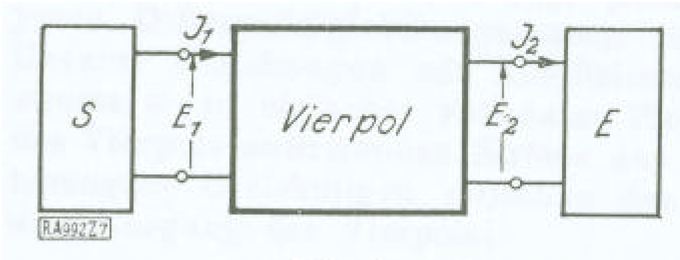
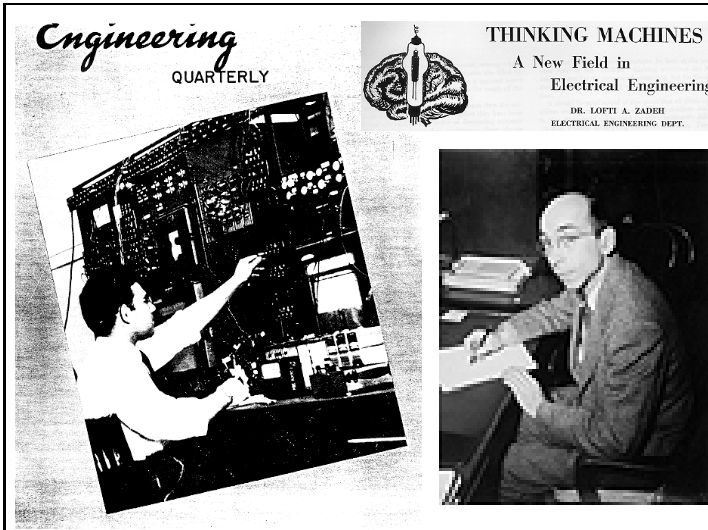
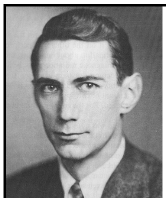


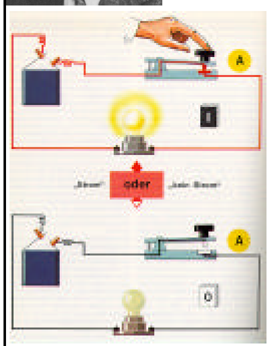
Abb. 7.





Claude E. Shannon

1938: Darstellung Boolescher Aussagen durch Schaltkreise



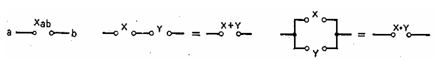


Figure 1 (left). Symbol for hindrance function

Figure 2 (middle). Interpretation of addition

Figure 3 (right). Interpretation of multiplication

Claude E. Shannon

Analogie zwischen Aussagen und Schaltungen (Shannon 1938)

Table I. Analogue Between the Calculus of Propositions and the Symbolic Relay Analysis

Symbol	Interpretation in Relay Circuits	Interpretation in the Calculus of Propositions
X	The circuit X	The proposition X
0	The circuit is closed	The proposition is false
1	The circuit is open	The proposition is true
$X + Y$	The series connection of circuits X Y	The proposition which is true if either X or Y is true
XY	The parallel connection of circuits X and Y	The proposition which is true if both X and Y are true
X'	The circuit which is open when X is closed, and closed when X is open	The contradictory of proposition X
$=$	The circuits open and close simultaneously	Each proposition implies the other

Relay Circuit Element	Symbolic Logic Interpretation
Circuit A	Statement A
Closed circuit	A is false
Open circuit	A is true
Series connection of A and B	A and/or B ($A \vee B$)
Parallel connection of A and B	A and B ($A \cdot B$)

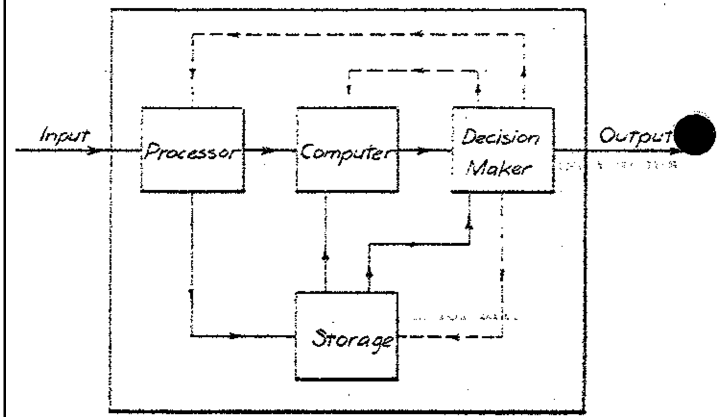


Figure 1—A schematic diagram illustrating how the basic elements of a thinking machine are arranged.

Zadeh, 1949 ff: System Theory

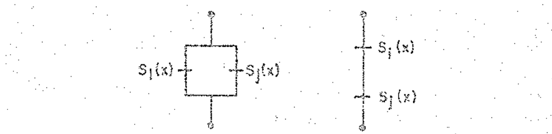


Fig. 2. Parallel and series connection of sieves simulating $\bigcup$ and $\bigcap$

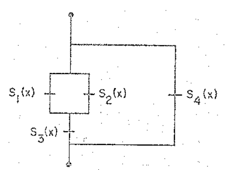
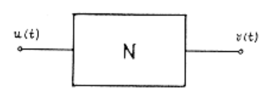


Fig. 3. A network of sieves simulating $\{[f_1(x) \vee f_2(x)] \wedge f_3(x)\} \vee f_4(x)$

Zadeh, 1949 ff: System Theory



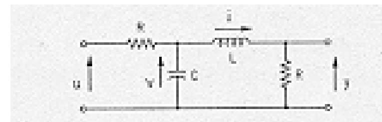


Fig. 1—Network for illustrative example.

$s_{t+1} = f(s_t, u_t)$, t = 0, 1, 2, ...

$y_t = g(s_t, u_t)$

y : output

u : input

s : state