



50683 Program Description I

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Program Title LINEAR SYSTEMS (COMPLEX COEFFICIENTS)

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Program Description, Equations, Variables

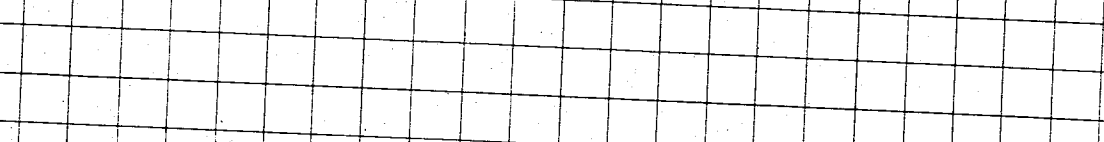
As for real coefficients the matrix of the system $m.m$ ($m=1,2,3,4$) is reduced to a diagonal matrix, after which the solution is found immediately.

Operating Limits and Warnings

The system is supposed to have one solution. Certain precautions have to be taken to avoid divisions by zero.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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A large grid of graph paper, consisting of 20 columns and 10 rows of squares, intended for calculations.
$$1^{\circ} \begin{cases} 2x + (1+2i)y + (1+i)z + 2it = 2+5i \\ 1 \quad (2-i) \quad -2i \quad i \quad 4+2i \\ 1 \quad 2 \quad i \quad -i \quad -1+2i \\ (1+2i) \quad 1 \quad 0 \quad 2 \quad 3+i \end{cases}$$

FIND: $x=1.000000001 + 0.000000001 i$
 $y=0.000000001 + 0.999999998 i$
 $z=0.999999998 + 1.000000001 i$
 $t=0.999999999 + 0.999999999 i$

2° $\begin{cases} (1+i)x + iy + (4+i)z = 9+5i \\ i & 2 & 2i & 1+3i \\ 1 & 2i & 3i & 3+9i \end{cases}$ FIND $x=1.000000000 + 1.000000003i$
 $y=0.999999999 - 1.000000001i$
 $z=2.000000000 + 0.000000000i$

$$\begin{aligned} 3^\circ \quad & \begin{cases} (2+i)x + (1+2i)y = 1+8i \\ 3 \quad \quad \quad i \quad \quad \quad 2+5i \end{cases} \quad \text{FIND} \quad \begin{aligned} x &= 1.000000001 + 0.999999999i \\ y &= 2.000000001 + 1.000000001i \end{aligned} \end{aligned}$$

4° $(3+2i)x=6+17i$ FIND $x=4.000000001 + 3.000000000 i$ (use E)

Solution(s)

Reference(s)

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
0011	*LBL A		enter m here	57	>		
2	2			58	GTO4		
3	x			59	GTO3		
4	STOO		$k=2m$	0060	*LBL 5		big last gap is filled
5	STOE		$k=k$	61	ISZ		
6	1		first equation	62	RCLi		
7	GSBa			63	RCLE		
8	GSBe			64	RCLO		
9	RCLE			65	-		
01010	STI		$i=k$	66	2		
11	GSBb		division routine	67	+		
12	*LBL 0		Make room for next equation	68	CHS		$\Delta i = -(k-k+2)$
13	GSB&c		$p = \text{number of preceding equations}$	69	C		
14	RCLO			0170	1		
15	x			71	6		
16	STI		$i=pk$	72	>		
17	*LBL 2			73	GTO5		
18	RCLi		$x = x_i$	74	2		
19	RCLE		$\Delta c = k$	75	STO-0		$k \rightarrow k-2$
02020	C		x moved over Δi spaces	76	RCLO		$k > 2?$
21	DSZ			77	>		
22	GTO2			78	GTOO		Case $k=2$ ($m=1$)
23	RCLD			79	RCLE		$i=k$
24	1		$m = p+1$ (number of next equation)	0080	STI		solution found
25	+			81	*LBL E		and shown
26	STO GSBa			82	RCLi		
27	CFO		reduce new equation	83	-x-		
28	D			84	DSZ		
29	GSBe			85	GTOE		
03030	STO GSBb			86	RCLE		
31	GSBc			87	STI		
32	SFO			88	RS		
33	D		reduce old equations	89	*LBL B		finishes $pk+k$
34	GSBc			0090	RCLO		
35	*LBL 3		fill gaps between remaining coefficients	91	RCLD		
36	RCLE		$i=k$	92	x		
37	STI			93	RCLE		
38	RCLD			94	+		
39	1			95	RTN		
04040	-			96	*LBL C		x stored in $sto(i+\Delta i)$ and i restored
41	STOD		$p \rightarrow p-1$	97	RCI		
42	=0			98	+		
43	GTO5			99	STI		
44	B			10000	↓		
45	STI		$i=pk+k$	101	STOi		
46	*LBL 4		small gaps are filled first	102	LSTX		
47	ISZ			103	STI		
48	RCLi			104	RTN		
49	XXX DSZ		$\Delta i = -2$	105	*LBL D		reducing equations
05050	XXX DSZ			106	F?O		
51	XXX STOi			107	GTO9		
52	XXX ISZ			108	RCLO		
53	XXX ISZ			109	STI		
54	XXX RCI			110	*LBL 7		
55	XXX 2			111	B		
56	XXX 0			112	RCLO		

all REGISTERS used

0	1	2	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	F	G	H	I	J
	factor	factor	p	k				i	



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Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	-		$\Delta i = ph + K - h$	169	$\Rightarrow$		
114	F?O			170	POLAR		
115	CHS			171	STOB		
116	RCI			172	$\Rightarrow$		
117	+			173	STOC		
118	STI			174	*LBL 1		
119	=0			175	RS		
120	GTO8			176	$\Rightarrow$		
121	LSTX			177	STOI		
122	GSBd			178	$\downarrow$		
123	$\uparrow$			179	DSZ		
124	STI			180	GTO1		
125	$\downarrow$			181	RTN		
126	STO-i			182	*LBL b		
127	$\downarrow$			183	GSBd		
128	DSZ			184	STOI		
129	STO-i			185	$\downarrow$		
130	DSZ			186	DSZ		
131	GTO7			187	STOI		
132	*LBL 8			188	DSZ		
133	RCLD			189	DSZ		
134	1			190	RTN		
135	-			191	GTOb		
136	STOD		$p \rightarrow p-1$	192	RTN		
137	*LBL 9			193	*LBL c		
138	B			194	RCLC		
139	RCLD			195	RCLC		
140	2			196	-		
141	x			197	2		
142	RCLC			198	:		
143	+		$k+2p$	199	1		
144	F?O			200	+		
145	$\Rightarrow$			201	STOD		
146	STI			202	RTN		
147	RCLi			203	*LBL d		
148	DSZ			204	DSZ		
149	RCLi			205	RCLi		
150	DSZ			206	ISZ		
151	$\Rightarrow$			207	RCLi		
152	POLAR			208	POLAR		
153	STOB			209	RCLB		
154	$\Rightarrow$			210	x		
155	STOC			211	$\Rightarrow$		
156	RCLC			212	RCLC		
157	F?O			213	+		
158	RCI			214	$\Rightarrow$		
159	STI			215	RECT.		
160	RCLD			216	RTN		
161	$\neq 0$		$p \neq 0$	217	*LBL e		
162	GTO7			218	RCLB		
163	RTN			219	1/X		
164	*LBL a			220	STOB		
165	RCLC		placing new equation	221	RCLC		
166	STI			222	CHS		
167	$\downarrow$			223	STOC		
168	RS		enter first coeff. here	224	RTN		

all LABELS used

A B C D E					0	1	2	3	SET STATUS		
a b c d e					0	1	2	3	FLAGS	TRIG	DISP
0					1	2	3	4	ON OFF	DEG	FIX
5					6	7	8	9	☐ ☒	☒	☒
									☐ ☒	GRAD	SCI
									☐ ☒	RAD	ENG
									☐ ☒		n 4