obvious modifications of the configuration of the value cards (type II) in the form of duplication of information.

When the problem actually is solved as described above, it is convenient but not necessary to have such devices as a box of some transparent material in which to stack the this time table, perhaps with a strategically placed light source to assist in observations. In fact, the design has been completed for a device to completely mechanize the process described so that the human operator has only to feed cards to a card reader with the solution carried out and the results recorded automatically.

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[1] Hans Reichenbach, *Elements of Symbolic Logic.* The Macmillan Company, New York, 1947. The notation used in this paper is that of Reichenbach except that his symbol "*v*" is replaced by the symbol "+".
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[3] Engineering Research Associates, *High-Speed Computing Devices.* McGraw-Hill Book Company, New York, 1950.
[4] Arthur W. Burks, Don W. Warren, & Jesse B. Wright, "An analysis of a logical machine using parenthesis-free notation," *MTAC*, v. 8, 1954, p. 53–57.

Tables for the Determination of Fundamental Solutions of Equations in the Theory of Compressible Fluids

1. The pseudo-logarithmic plane. It has been shown[1,2,3] that it is useful, when applying the hodograph method,[4] to consider the stream function ψ and the potential function ϕ of compressible fluids in the so-called pseudo-logarithmic plane. In the case when the pressure density equation is $p = \sigma\rho^\gamma$, σ, γ being constants, and for subsonic flows, the cartesian coordinates of the pseudo-logarithmic plane are

$$(1)\quad \lambda = \tfrac{1}{2}\log\left[\frac{1-T}{1+T}\left(\frac{1+hT}{1-hT}\right)^{1/h}\right],\quad T = (1-M^2)^{\frac{1}{2}},\quad h = \left(\frac{\gamma-1}{\gamma+1}\right)^{\frac{1}{2}},$$

and θ where M is the Mach number and θ is the angle which the velocity vector forms with the positive x direction of the physical plane (*i.e.*, the plane in which the flow actually takes place).[5]

The equations for the potential (ϕ) and the stream function (ψ) assume, when considering the flow in the λ, θ-plane, the form

$$(2)\qquad \phi_{\lambda\lambda} + \phi_{\theta\theta} + [l^{\frac{1}{2}}(l^{-\frac{1}{2}})_\lambda]\phi_\lambda = 0,\quad \phi_\lambda \equiv \frac{\partial\phi}{\partial\lambda},\cdots$$

$$(3)\qquad \psi_{\lambda\lambda} + \psi_{\theta\theta} + [l^{-\frac{1}{2}}(l^{\frac{1}{2}})_\lambda]\psi_\lambda = 0.$$

Here $l \equiv l(\lambda) = \rho^{-2}(1 - M^2)$ is a known function[6] of λ. If we introduce so-called *modified stream and potential functions*

$$\psi^* = \psi/\kappa, \tag{4}$$

$$\phi^* = \kappa\phi, \tag{5}$$

$$\kappa = (1 - M^2)^{-\frac{1}{4}}(1 + \tfrac{1}{2}(\gamma - 1)M^2)^{-[\frac{1}{2}(\gamma-1)]} \tag{6}$$

then we obtain for ψ^* and ϕ^* equations

$$\psi^*_{\lambda\lambda} + \psi_{\theta\theta} + 4F_1(\lambda)\psi^* = 0, \tag{7}$$

$$\phi^*_{\lambda\lambda} + \phi^*_{\theta\theta} + 4F_2\phi^* = 0 \tag{8}$$

where[7]

$$F_n = (-1)^n \frac{(\gamma + 1)M^4}{64}\left[\frac{a_n M^4 + 4(3 - 2\gamma)M^2 - 16}{(1 - M^2)^3}\right], \quad n = 1, 2, \tag{9}$$

$$a_1 = (3\gamma - 1), \quad a_2 = \gamma - 3.$$

2. Singular solutions of type $\mathcal{S}$. By a fundamental solution of a linear differential equation we mean a function $\mathcal{S}^*(\lambda, \theta; \lambda_0, \theta_0)$ which for a fixed (λ_0, θ_0) is a solution of the differential equation and which possesses a logarithmic singularity in the vicinity of (λ_0, θ_0). In the case of equations (2) and (3) singularities of this type (denoted as singularities of type $\mathcal{S}$)[8] can be obtained by continuing the coefficients F_1 and F_2 to complex values of λ and then forming for ψ^* the expression

$$\tfrac{1}{2}A[\log(\lambda - \lambda_0)^2 + (\theta - \theta_0)^2] + B \tag{10}$$

where

$$A = H\left[1 - \int_{Z_0}^{Z}\int_{\bar{Z}_0}^{\bar{Z}} F_1 dZ_1 d\bar{Z}_1 + \int_{Z_0}^{Z}\int_{\bar{Z}_0}^{Z} F_1\left(\int_{Z_0}^{Z_1}\int_{\bar{Z}_0}^{\bar{Z}_1} F_1 dZ_2 d\bar{Z}_2\right) dZ_1 d\bar{Z}_1 + \cdots\right], \tag{11}$$

$$B = H\left[\int_{Z_0}^{Z}\int_{\bar{Z}_0}^{\bar{Z}} G_1 dZ_1 d\bar{Z}_1 - \int_{Z_0}^{Z}\int_{\bar{Z}}^{\bar{Z}} F_1\left(\int_{Z_0}^{Z_1}\int_{\bar{Z}_0}^{\bar{Z}_1} G dZ_2 d\bar{Z}_2\right) dZ d\bar{Z}_1 + \cdots\right], \tag{12}$$

$$G = -\frac{1}{\xi}\frac{\partial(H^{-1}A)}{\partial Z} - \frac{1}{\zeta}\frac{\partial(H^{-1}A)}{\partial \bar{Z}}, \quad \zeta = Z - Z_0, \quad \xi = \bar{Z} - \bar{Z}_0,$$

$$Z = \lambda + i\theta, \quad \bar{Z} = \lambda - i\theta, \quad Z_0 = \lambda_0 + i\theta_0, \quad \bar{Z}_0 = \lambda_0 - i\theta_0.$$

We obtain the corresponding singularity ϕ^* replacing in A and B functions H and F_1 by H^{-1} and F_2, respectively.[9]

In order to evaluate numerically the integrals in (11) and (12) and corresponding expressions for ϕ^* we need the tables of $\mathrm{Re}(F_\kappa)$, $\mathrm{Im}(F_\kappa)$, $\kappa = 1, 2$ for complex values of the arguments λ.

Re(λ)	Im(λ)	Re(T)	Im(T)	Re(F_1)	Im(F_1)	Re(F_2)	Im(F_2)
− ∞	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
−1.1513	0.0000	.9750	0.0000	.0017	0.0000	− .0068	.0000
	.0654	.9752	− .0034	.0016	.0005	− .0066	− .0019
	.1309	.9759	− .0069	.0014	.0009	− .0059	− .0038
	.1963	.9772	− .0100	.0010	.0013	− .0043	− .0051
	.2617	.9788	− .0130	.0007	.0015	− .0026	− .0061
	.3271	.9808	− .0157	.0003	.0016	− .0008	− .0064
	.3925	.9833	− .0180	− .0003	.0015	+ .0010	− .0062
	.4579	.9859	− .0200	− .0007	.0014	.0026	− .0056
	.5233	.9888	− .0216	− .0011	.0011	.0040	− .0045
	.5887	.9918	− .0228	− .0012	.0008	.0049	− .0032
	.6541	.9949	− .0235	− .0014	.0005	.0054	− .0017
	.7195	.9980	− .0238	− .0014	.0001	.0055	− .0003
	.7849	.9989	− .0237	− .0013	− .0001	.0054	.0001
−0.8047	.0000	.9473	.0000	.0087	.0000	− .0348	.0000
	.0654	.9478	− .0076	.0081	.0027	− .0329	− .0112
	.1309	.9496	− .0151	.0068	.0052	− .0270	− .0210
	.1963	.9526	− .0219	.0046	.0069	− .0185	− .0276
	.2617	.9565	− .0282	.0022	.0077	− .0087	− .0308
	.3271	.9613	− .0339	− .0003	.0077	.0013	− .0307
	.3925	.9667	− .0385	− .0024	.0069	.0098	− .0276
	.4579	.9726	− .0422	− .0041	.0056	.0164	− .0223
	.5233	.9789	− .0450	− .0053	.0040	.0208	− .0158
	.5887	.9852	− .0469	− .0059	.0023	.0231	− .0091
	.6541	.9916	− .0479	− .0058	.0006	.0233	− .0026
	.7195	.9981	− .0479	− .0055	− .0009	.0218	.0034
	.7849	1.0042	− .0473	− .0049	− .0021	.0193	.0083
−0.6020	.0000	.9161	.0000	.0259	.0000	− .1044	.0000
	.0654	.9172	− .0129	.0238	.0095	− .0961	− .0383
	.1309	.9206	− .0252	.0181	.0169	− .0732	− .0684
	.1963	.9261	− .0366	.0106	.0212	− .0416	− .0854
	.2617	.9332	− .0466	.0025	.0221	− .0092	− .0885
	.3271	.9416	− .0551	− .0045	.0200	.0190	− .0802
	.3925	.9510	− .0618	− .0098	.0162	.0396	− .0643
	.4579	.9608	− .0669	− .0130	.0115	.0523	− .0454
	.5233	.9709	− .0703	− .0143	.0066	.0575	− .0262
	.5887	.9810	− .0721	− .0143	.0022	.0570	− .0088
	.6541	.9909	− .0727	− .0134	− .0015	.0527	.0059
	.7195	1.0004	− .0719	− .0115	− .0043	.0456	.0173
	.7849	1.0094	− .0701	− .0093	.0064	.0371	.0257
−0.5281	.0000	.9000	.0000	.0401	.0000	− .1621	0.0000
−0.4582	.0000	.8810	.0000	.0629	.0000	− .2556	.0000
	.04	.88181	− .0120	.06018	.01654	− .2441	− .0679
	.0654	.8830	− .0195	.0558	.0261	− .2266	− .1072
	.1309	.8888	− .0380	.0381	.0445	− .1521	− .1818
	.1963	.8980	− .0545	.0158	.0515	− .0608	− .2081
	.20	.89856	− .05522	.01459	.05137	− .0564	− .2079
−0.4582	.2617	.9094	− .0684	− .0041	.0483	.0194	− .1939
	.3271	.9227	− .0794	− .0184	.0388	.0757	− .1541
	.3925	.9368	− .0877	− .0265	.0272	.1069	− .1064
	.4579	.9511	− .0932	− .0293	.0156	.1172	− .0612
	.5233	.9653	− .0967	− .0289	.0060	.1146	− .0226
	.5887	.9791	− .0978	− .0260	− .0018	.1030	.0072
	.6541	.9923	− .0973	− .0221	− .0073	.0874	.0292
	.7195	1.0048	− .0953	− .0176	− .0112	.0701	.0443
	.7849	1.0163	− .0919	− .0133	− .0135	.0529	.0535

Re(λ)	Im(λ)	Re(T)	Im(T)	Re(F_1)	Im(F_1)	Re(F_2)	Im(F_2)
−0.3466	.0000	.8403	.0000	.1425	.0000	− .5853	.0000
	.04	.84168	− .01751	.12942	.04434	− .5462	− .1849
	.0654	.8436	− .0285	.1195	.0689	− .4881	− .2877
	.10	.84825	− .0426	.09286	.09366	− .3746	− .3879
	.1309	.8535	− .0547	.0674	.1070	− .2591	− .4416
	.17	.86179	− .06835	.03083	.11160	− .1167	− .4561
	.1963	.8682	− .0769	.0095	.1087	− .0294	− .4411
	.2617	.8860	− .0945	− .0295	.0877	.1274	− .3491
	.3271	.9050	− .1075	− .0496	.0596	.2044	− .2341
	.3925	.9247	− .1163	− .0556	.0337	.2241	− .1293
	.4579	.9438	− .1215	− .0534	.0133	.2119	− .0494
	.5233	.9625	− .1240	− .0468	− .0016	.1845	.0088
	.5887	.9799	− .1238	− .0385	− .0114	.1517	.0466
	.6541	.9961	− .1215	− .0304	− .0177	.1189	.0699
	.7195	1.0110	− .1175	− .0224	− .0212	.0887	.0829
	.7849	1.0246	− .1123	− .0157	− .0227	.0620	.0889
−0.2682	.0000	.8000	.0000	.2837	.0000	−1.181	.0000
− .2562	.3275	.8889	− .1390	− .1050	.0718	.4285	− .2722
− .2560	.5237	.9625	− .1515	− .0643	− .0179	.2507	.0743
	.7193	1.0188	− .1388	− .0248	− .0334	.0970	.1298
− .2559	.1968	.8375	− .1049	− .0365	.2015	.1749	− .8151
− .2558	.5889	.9829	− .1491	− .0991	− .0272	.1907	.1075
− .2557	.0000	.7921	.0000	.3217	.0000	−1.342	.0000
	.0653	.7980	− .0408	.2413	.1821	− .9944	− .7737
	.2623	.8633	− .1255	− .0923	.1312	.3900	− .5160
	.3926	.9155	− .1472	− .0966	.0270	.3846	− .0952
− .2554	.0256	.7930	− .0163	.30819	.08095	−1.284	−0.3456
	.0502	.7956	− .03165	.27223	.14881	−1.127	− .6331
	.09987	.8056	− .06055	.15893	.23065	− .6380	− .9700
	.14	.81717	− .08116	.06324	.24157	− .2327	−1.002
− .2552	.1313	.8144	− .0768	.0835	.2427	−.3171	−1.010
	.6540	1.0018	− .1450	− .0359	− .0317	.1397	.1247
− .2550	.4578	.9398	− .1510	− .0813	− .0010	.3184	.0113
− .2549	.7852	1.0343	− .1316	− .0156	− .0330	.0618	.1289
− .2173	.3329	.8863	− .1563	− .1371	.0607	.5543	− .2191
− .1815	.5791	.9848	− .1737	− .0577	− .0460	.2211	.1807
− .1813	.0000	.7330	.0000	.7736	.0000	−3.307	.0000
− .1806	.0648	.7434	− .0590	.4632	− .5113	−1.908	−2.230
− .1792	.6544	1.0095	− .1670	− .0372	− .0479	.1434	.1864
− .1787	.3272	.8780	− .1739	− .1785	.0518	.7174	− .1713
− .1785	.2624	.8434	− .1620	.0022	.0077	.8638	− .5537
− .1783	.0000	.7223	.0000	.78138	.0000	−3.862	.0000
	.0242	.7339	− .02275	.72795	.24278	−3.100	−1.068
	.04	.73691	− .03669	.64325	.36818	−2.718	−1.614
	.05006	.7390	− .0462	.57508	.44169	−2.412	−1.929
	.10	.75633	− .08624	.19955	.56744	− .7558	−2.422
	.10026	.7569	− .0868	.19337	.56525	− .7292	−2.411
	.2192	.8198	− .1494	− .20073	.2465	.8695	− .9593
	.5893	.9886	− .1738	− .0544	− .0474	.2093	.1855
− .1781	.7197	1.0279	− .1587	− .0236	− .0465	.0929	.1792
− .1780	.7856	1.0449	− .1493	− .0128	− .0434	.0523	.1684
− .1779	.3921	.9097	− .1800	− .1414	− .0017	.5529	.0283
	.4576	.9388	− .1813	− .1064	− .0293	.4096	.1268
− .1778	.1968	.8072	− .1414	− .1816	.3108	.8132	−1.229
− .1777	.1307	.7709	− .1074	.0116	.5161	.0452	−2.161
	.5244	.9655	− .1792	− .0771	− .0426	.2951	.1722

Re(λ)	Im(λ)	Re(T)	Im(T)	Re(F_1)	Im(F_1)	Re(F_2)	Im(F_2)
−.1644	.1739	.7878	−.1389	−.1904	.4119	.8786	−1.659
−.1473	.0000	.7000	.0000	1.2236	.0000	−5.309	.0000
−.1160	.0000	.6570	.0000	2.1870	.0000	−9.677	.0000
−.1142	.3268	.8711	−.2100	−.2491	−.0087	.9739	.0952
−.1136	.5911	1.0176	−.1875	−.0347	−.0645	.1333	.2470
−.1127	.2642	.8304	−.2031	−.3484	.0849	1.416	−.2377
−.1123	.0629	.6762	−.0867	.7043	1.5800	−2.802	−7.041
−.1116	.04073	.66325	−.0589	1.43653	1.4304	−6.153	−6.487
	.05	.66858	−.06762	1.17971	1.48423	−5.371	−6.113
	.06	.67341	−.08015	.86799	1.56464	−3.538	−7.002
	.0798	.6870	−.1062	.25015	1.50623	−.7528	−6.596
	.15819	.7496	−.1676	−.48526	.60628	2.214	−2.382
−.1112	.3902	.9072	−.2134	−.1767	−.0529	.6739	.2390
−.1108	.5883	.9964	−.1963	−.0537	−.0688	.2025	.2650
	.7172	1.0376	−.1779	−.0198	−.0595	.0785	.2281
−.1101	.5261	.9717	−.2056	−.0805	−.0725	.3015	.2850
−.1095	.4572	.9413	−.2120	−.1210	−.0703	.4645	.2938
−.1094	.1982	.7807	−.1874	−.4784	.3192	2.058	−1.160
−.1092	.1294	.7243	−.1516	−.4305	.9191	2.099	−3.769
−.1087	.7854	1.0564	−.1664	−.0078	−.0536	.0344	.2065
−.1061	.0906	.6894	−.1216	−.0455	1.4992	.5786	−6.479
−.0807	.0000	.6000	.0000	.4668	.0000	−21.26	.0000
−.0628	.0468	.5909	−.1042	1.0202	5.0430	−3.409	−23.27
−.0613	.3248	.8680	−.2443	−.2913	−.0969	1.098	.4646
−.0610	.6497	1.0255	−.2056	−.0293	−.0791	.1134	.2999
−.0607	.0000	.5549	.0000	8.5619	.0000	−39.90	.0000
−.0590	.5957	1.0062	−.2159	−.0461	−.0879	.1732	.3337
−.0572	.2700	.8270	−.2454	−.4358	−.0673	1.694	.4255
−.0554	.0577	.5913	−.1321	−.7605	4.9886	5.036	−22.47
−.0528	.3838	.9062	−.2472	−.1961	−.1203	.7184	.5060
−.0527	.03085	.5521	−.0828	3.78079	7.85575	−16.07	−36.92
	.04	.5632	−.1030	1.4420	7.2060	−4.884	−33.74
	.04936	.5756	−.1213	−.16725	6.18058	2.574	−28.37
−.0506	.7115	1.0471	−.1967	−.0138	−.0723	.0567	.2743
−.0499	.5312	.9821	−.2311	−.0719	−.1034	.2627	.3958
−.0460	.2024	.7650	−.2459	−.7883	.0236	3.215	.2607
−.0457	.1260	.6769	−.2170	−1.6765	.8002	7.586	−2.639
−.0444	.4555	.9469	−.2442	−.1203	−.1201	.4342	.4732
−.0439	.7850	1.0692	−.1831	−.0006	−.0629	.0085	.2414
−.0423	.0000	.5000	.0000	.1836	.0000	−88.02	.0000
−.0407	.3229	.8670	−.2586	−.3007	−.1398	1.111	.6361
−.0391	.0000	.4889	.0000	21.5359	.0000	−103.8	.0000
−.0385	.6966	1.0287	−.2137	−.0268	−.0854	.1028	.3228
−.0365	.6001	1.0122	−.2236	−.0407	−.0950	.1513	.3584
−.0349	.0233	.4924	−.0868	.1402	.1818	−26.78	−88.88
−.0338	.2757	.8307	−.2648	−.4330	−.1516	1.632	.7649
−.0301	.0487	.5392	−.1655	−5.3652	7.5268	28.27	−32.98
−.0275	.1201	.6578	−.2394	−2.2320	.4906	9.923	−.8918
−.0256	.0000	.4309	.0000	51.3924	.0000	−255.0	.0000
	.00192	.4312	−.0098	50.4590	7.79669	−250.3	−39.89
	.01358	.4438	−.0655	21.74356	33.62862	−101.9	−169.4
	.02930	.4773	−.1227	−4.06835	21.9170	26.47	−105.1
	.05023	.5265	−.1714	−7.00589	8.07236	36.54	−35.04
	.06358	.5557	−.1926	−5.77547	4.41078	28.88	−17.62
	.10204	.6280	−.2309	−2.98574	.92169	13.68	−2.415
−.0254	.3774	.9047	−.2647	−.2005	−.1587	.7174	.6559
−.0236	.1224	.6546	−.2622	−2.3558	−.0276	10.15	1.591

Re(λ)	Im(λ)	Re(T)	Im(T)	Re(F_1)	Im(F_1)	Re(F_2)	Im(F_2)
− .0231	.0691	.5638	− .2052	− .5637	3.2184	27.62	−11.91
− .0220	.7055	1.0514	− .2067	− .0103	− .0790	.0441	.2980
− .0201	.0000	.4000	.0000	844.3000	.0000	425.2	.0000
− .0186	.1943	.7518	− .2736	− .9256	− .1897	3.651	1.261
− .0172	.5367	.9901	− .2436	− .0622	− .1173	.2228	.4440
− .0168	.0108	.3939	− .0695	.3536	.7888	165.4	−404.9
− .0151	.0367	.4698	− .1710	− .1631	.1449	85.83	−63.54
− .0114	.4538	.9511	− .2617	− .1125	− .1477	.3944	.5708
− .0103	.7851	1.0768	− .1919	.0043	− .0674	− .0086	.2580
− .0072	.0175	.3759	− .1368	− .5972	.7007	328.2	−339.0
− .00225	.0000	.1988	.0000	6885.0000	.0000	37290.	.0000
	.07135	.5483	− .2550	−7.03253	− .39862	32.28	6.548
	.12327	.6520	− .28075	−2.36513	− .46519	9.866	3.587
	.19557	.7516	− .29248	− .91111	− .35304	3.467	1.948
	.26137	.8190	− .29218	− .47980	− .27753	1.733	1.302
	.32557	.8718	− .28652	− .28247	− .22472	.9905	.9555
	.38922	.9153	− .27770	− .17482	− .18566	.6056	.7419
	.45699	.9544	− .26600	− .10642	− .15368	.3697	.5904
−0.00225	.52564	.9881	− .25254	− .06310	− .12835	.2232	.4829
	.58995	1.01533	− .23890	− .03620	− .10919	.1327	.4081
	.64888	1.03721	− .22580	− .01886	− .09458	.0736	.3540
	.72008	1.060335	− .20940	− .00682	− .07979	.0242	.3070
	.78546	1.07880	− .19395	− .00561	− .06838	− .0132	.2616
	.0401	.4560	− .22137	−21.8887	1.16194	108.3	6.996
	.0060	.2600	− .10704	−638.0050	549.7400	3535.	−2818.
0.0000	.0000	.0000	.0000	∞	∞	− ∞	.0000
	.0248	.38623	− .2030	−57.2950	−1.7443	292.2	38.01
	.0751	.5435	− .25965	−7.2871	− .84843	33.23	8.931
	.1238	.6522	− .2846	−2.3708	− .54963	9.684	3.956
	.1967	.7528	− .29514	− .89654	− .37663	3.389	2.023
	.2612	.8190	− .29424	− .47812	− .28723	1.719	1.340
	.3260	.8724	− .28813	− .27990	− .22929	.9775	.9714
	.3888	.9156	− .27913	− .17371	− .18860	.5998	.7523
	.4622	.95759	− .2662	− .10146	− .15322	− .4153	.5435
	.5251	.9883	− .25368	− .06264	− .12966	.2212	.4875
	.5899	1.0158	− .2398	− .03561	− .10998	.1304	.4107
	.6491	1.0378	− .22653	− .01829	− .09509	.0716	.3558
	.7193	1.0608	− .21012	− .00360	− .08023	.0204	.3029
	.7857	1.0794	− .1945	.00605	− .06863	− .0146	.2626
.0019	.0187	.3464	− .2000	− .9771	− .2243	285.6	93.65
.0062	.0371	.4330	− .2500	− .2369	− .9431	112.0	62.84
.0163	.0644	.5196	− .3000	− .7018	−4.6774	29.15	27.79
.0188	.2894	.8457	− .3078	− .3533	− .3165	1.200	1.362
.0366	.1012	.6062	− .3500	−2.2466	−2.5925	7.405	13.43
.0722	.1447	.6928	− .4000	− .6400	−1.5496	1.066	6.842
.0984	.3893	.9397	− .3420	− .0772	− .2886	.1881	1.053
.1273	.1894	.7794	− .4500	− .0350	− .9719	− .7788	3.576
.2022	.2275	.8660	− .5000	.2100	− .6235	−1.200	1.871

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[5] See page 462 of the reference of note 3.

[6] See the reference in note 2 and equations (2.8) and (2.9) of the reference in note 3.

[7] See page 465 of the reference of note 3, where symbols F and P were used for the F_1 and F_2 of the present paper.

[8] See page 472 of the reference of note 3.

[9] We note that when we are carrying out the integrations in (11) and (12), λ_n are continued to *complex* values $\lambda_n + i\Lambda_n$, and $Z_n = \lambda_n + i\Lambda_n$ and $\bar{Z}_n = \lambda_n - i\Lambda_n$ become two *independent* variables. Also see page 473 of the reference in note 3.

Analysis of Problem Codes on the Maniac

The Los Alamos computer, the MANIAC, has solved problems of wide variety during the last few years. The mathematical structure of such problems has ranged from differential equations (particularly partial differential equations), integral equations, stochastic processes, purely algebraic problems to some in the domain of mathematical logics.

There are several reasons why a frequency analysis of the computer as used in several typical problems might be useful. From such a study one may learn of significant variations in such distributions from one type of problem to another. Further, one may reach conclusions about the selection of the computer vocabulary. Most importantly, however, one may use the quantitative results as guiding principles in the design of a new computer. The economy of computer design is connected with the question, "Is the desirability of a particular order[1] commensurate with the associated electronic hardware?" Finally, a frequency analysis enables one to form accurate estimates for the "running time" of a problem; this information aids considerably in efficient scheduling of computer time. A knowledge of operation times for subroutines enables one to make rather good time estimates of lengthy problems during the formulation stage.

These frequency distributions can, of course, be gathered by hand. A more obvious way is to have the computer itself perform the analyses. A routine has been developed for this purpose and is called the "Code Analyzer."

The Code Analyzer gives the following information about a computer problem:

1. the frequency of occurrence of each order as it appears in the code—more briefly, a "static" count
2. the distribution in per cent of these static counts
3. the frequency of performance of each order during the running of a representative cycle of the problem—more briefly, a "dynamic" count
4. the distribution in per cent of these dynamic counts
5. the total time consumed performing each order of the vocabulary; i.e., (3) multiplied by the time needed to perform one such order
6. the per cent of the total time used by each order
7. the totals for (1), (3), (5).

The count in (1) is obtained by simply scanning linearly through the code of the problem and recording the occurrence of each order. The distribution (2) is