TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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TABLES OF STIFFNESS AND CARRY-OVER FACTOR FOR STRUCTURAL MEMBERS UNDER AXIAL LOAD

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SUMMARY

Tables of stiffness and carry-over factor are presented for members in which the cross section and axial load do not vary along the length of the member. These tables are of use in solving problems in the stability of structural members under axial load as well as in applications of the Cross method of moment distribution when the effects of axial load in the members are considered. The interval between successive values of the argument is small enough to make interpolation unnecessary in engineering calculations.

INTRODUCTION

The method of moment distribution developed by Hardy Cross (reference 1) can frequently be used to advantage in the stress analysis of continuous beams, continuous frames, and rigid joint trusses, some cases of which occur in aeronautical structures. In reference 2 James summarized the principles of the Cross method and extended it to show how the effects of axial load in the members may be considered in a moment-distribution analysis. In reference 3 the Cross method was further extended to show how the principles of moment distribution may be used to solve problems in the stability of structural members under axial load.

In the stability calculations as well as in a moment-distribution analysis where the effects of axial load are considered, it is desirable to have tables giving the stiffness and carry-over factor as a function of the axial load and properties of the member. Such a set of tables is presented in this paper.

The tables apply to members for which the cross section and axial load do not vary along the length of the member. The interval between successive values of the argument was made so small that no interpolation will be necessary when the tables are used in engineering calculations.

DEFINITIONS AND SYMBOLS

The following definitions of stiffness and carry-over factor are the same as those given in reference 3, which parallel the definitions given in references 1 and 2 with some changes in wording.

Stiffness

If a member is on unyielding supports at each end, the moment at one end necessary to produce a rotation of one-fourth radian of that end is called the "stiffness." The stiffness of a member will depend upon the amount of restraint at the far end. In the derivation of the criterion for stability as given in reference 3, three types of restraint at the far end are considered. The symbols used to designate the stiffness for the different types of restraint are:

S, far end fixed.

S', far end elastically restrained.

S", far end pinned.

The stiffness of a member computed according to the foregoing definition is one-fourth that computed according to the definition given in references 1 and 2. In the Cross method the relative stiffness of the members is of importance and not the absolute value. The foregoing definition was selected so that the stiffness of a member of constant cross section with no axial load and fixed at the far end would be $\bar{E}I/L$ instead of $4\bar{E}I/L$.

Carry-Over Factor

If a member is on unyielding supports at each end and

a moment is applied at the near end, the ratio of the moment developed at the far end to the moment applied at the near end is called the "carry-over factor." As in the case of stiffness, the carry-over factor will depend upon the degree of restraint at the far end of the member. The symbols used to designate the carry-over factor for the different types of restraint are:

C, far end fixed.

C', far end elastically restrained.

C'' = 0, far end pinned.

Sign Convention

The sign convention used in this report is the same as that used in references 2 and 3. A clockwise moment acting on the end of a member is positive. A counterclockwise moment acting on a joint is positive. An external moment applied at a joint is considered to act on the joint.

Symbols

E, modulus of elasticity.

$\overline{E}$, effective modulus of elasticity.

I, moment of inertia of cross section of member about a centroidal axis normal to the plane of bending.

L, length of member.

P, axial load in member (absolute value).

$$\alpha = 6\,\frac{\frac{L}{j}\csc\frac{L}{j} - 1}{\left(\frac{L}{j}\right)^2}$$

$$\beta = 3\,\frac{1 - \frac{L}{j}\cot\frac{L}{j}}{\left(\frac{L}{j}\right)^2}$$

} For compression members

$$\alpha = 6\,\frac{\frac{L}{j}\operatorname{csch}\frac{L}{j} - 1}{-\left(\frac{L}{j}\right)^2}$$

$$\beta = 3\,\frac{1 - \frac{L}{j}\coth\frac{L}{j}}{-\left(\frac{L}{j}\right)^2}$$

For tension members

$$j = \sqrt{\frac{EI}{P}}$$

$$\frac{L}{j} = L\sqrt{\frac{P}{EI}}$$

$$\left(\frac{L}{j}\right)_{eff} = L\sqrt{\frac{P}{\overline{E}I}}$$

Effective values of α and β are obtained by substitution of $(L/j)_{eff}$ for L/j.

FORMULAS USED IN CALCULATION OF TABLES

In tables I and II for compression and tension, respectively, the far end of the member is considered as either pinned or fixed. The stiffness and carry-over factor that applies when the far end is elastically restrained is expressed in terms of these quantities by formulas given in reference 3.

The argument in tables I and II is $(L/j)_{eff}$. In the elastic range $\overline{E} = E$ and $(L/j)_{eff} = (L/j)$. Above the elastic range, however, it is necessary to use a reduced modulus $\overline{E}$, which is called the "effective modulus." In reference 3 it is shown how the effective modulus can be

obtained from the accepted column formula for the material comprising the member.

The second, third, and fourth columns in tables I and II were computed by means of the following formulas:

$$C = \frac{\alpha}{2\beta} \tag{1}$$

$$\frac{S''}{\left(\frac{\bar{E}I}{L}\right)} = \frac{3}{4\beta} \tag{2}$$

$$\frac{S}{\left(\frac{\bar{E}I}{L}\right)} = \frac{S''}{\left(\frac{\bar{E}I}{L}\right)} \left[\frac{1}{1 - C^2}\right] \tag{3}$$

These equations were first presented by James in reference 2 except that the more general form of equation (3) is taken from reference 3.

The last two columns in tables I and II were obtained from the preceding columns as indicated by their headings. These columns are included because of their convenience in stability calculations (reference 3).

ACCURACY OF TABLES

The tables of reference 4 were used in the preparation of tables I and II. All calculations were made using eight significant figures. Equations (1), (2), and (3) were used in the form and order given to calculate the second, third, and fourth columns. The fifth column was obtained by squaring the second column. The sixth column was obtained by squaring the fourth column and multiplying by the fifth column. The last column was therefore made to depend upon all preceding columns. All values were then tabulated to six significant figures and the differences for the last

column were studied; in some cases as much as the fourth difference was used. An independent check was also made for a series of values throughout the tables as well as where errors were suggested by irregular differences. In each case where errors were suspected, they were traced to the tables of reference 4.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., May 12, 1938.

REFERENCES

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2. James, Benjamin Wylie: Principal Effects of Axial Load on Moment-Distribution Analysis of Rigid Structures. T.N. No. 534, N.A.C.A., 1935.

3. Lundquist, Eugene E.: Stability of Structural Members under Axial Load. T.N. No. 617, N.A.C.A., 1937.

4. Hayashi, Keiichi: Sieben- und mehrstellige Tafeln der Kresi- und Hyperbelfunktionen und deren Produckte sowie der Gammafunktion. Julius Springer (Berlin), 1926.

TABLE I
COMPRESSION

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
0	0.500000	0.750000	1.000000	0.250000	0.250000
.1	.500243	.749505	.999464	.250243	.250075
.2	.501001	.747996	.998663	.251002	.250332
.3	.502260	.745488	.996996	.252265	.250758
.4	.504034	.741963	.994656	.254050	.251342
.5	.506333	.737410	.991639	.256373	.252104
.6	.509173	.731812	.987943	.259257	.253043
.7	.512572	.725149	.983561	.262730	.254163
.8	.516555	.717398	.978486	.266829	.255471
.9	.521146	.708528	.972709	.271593	.256971
1.0	.526380	.698505	.966221	.277075	.258673
1.01	.526940	.697438	.965532	.277665	.258854
1.02	.527506	.696358	.964837	.278263	.259038
1.03	.528080	.695267	.964134	.278869	.259224
1.04	.528661	.694164	.963424	.279482	.259411
1.05	.529249	.693049	.962707	.280104	.259602
1.06	.529845	.691921	.961982	.280734	.259794
1.07	.530445	.690782	.961250	.281372	.259988
1.08	.531054	.689630	.960511	.282018	.260185
1.09	.531669	.688466	.959764	.282672	.260383
1.10	.532293	.687289	.959011	.283336	.260584
1.11	.532923	.686100	.958249	.284007	.260787
1.12	.533561	.684899	.957481	.284687	.260992
1.13	.534205	.683685	.956705	.285375	.261200
1.14	.534858	.682459	.955922	.286073	.261410
1.15	.535517	.681220	.955131	.286779	.261621
1.16	.536185	.679968	.954333	.287494	.261836
1.17	.536859	.678704	.953527	.288218	.262052
1.18	.537542	.677427	.952715	.288951	.262271
1.19	.538232	.676137	.951894	.289693	.262492
1.20	.538929	.674834	.951066	.290445	.262715
1.21	.539635	.673518	.950231	.291206	.262941
1.22	.540348	.672190	.949388	.291976	.263169
1.23	.541069	.670848	.948538	.292755	.263399
1.24	.541798	.669493	.947680	.293545	.263632
1.25	.542535	.668125	.946814	.294344	.263867
1.26	.543279	.666744	.945941	.295153	.264104
1.27	.544033	.665350	.945061	.295971	.264344
1.28	.544794	.663942	.944173	.296800	.264586
1.29	.545563	.662521	.943277	.297639	.264830
1.30	.546341	.661086	.942374	.298488	.265078
1.31	.547127	.659638	.941462	.299347	.265327
1.32	.547921	.658176	.940544	.300217	.265579
1.33	.548724	.656701	.939618	.301098	.265833
1.34	.549535	.655212	.938683	.301989	.266090
1.35	.550355	.653709	.937742	.302890	.266350
1.36	.551183	.652192	.936792	.303803	.266611
1.37	.552021	.650661	.935835	.304727	.266876
1.38	.552867	.649116	.934870	.305662	.267143
1.39	.553722	.647557	.933897	.306608	.267412
1.40	.554585	.645984	.932917	.307565	.267684

TABLE I (Continued)
COMPRESSION

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
1.41	.555458	.644397	.931728	.308554	.247959
1.42	.556340	.642795	.930932	.309515	.248236
1.43	.557231	.641179	.929928	.310507	.248516
1.44	.558132	.639549	.928916	.311511	.248798
1.45	.559041	.637903	.927896	.312527	.249084
1.46	.559961	.636244	.926869	.313556	.249371
1.47	.560889	.634569	.925833	.314597	.249662
1.48	.561827	.632880	.924790	.315650	.249955
1.49	.562775	.631176	.923738	.316716	.250251
1.50	.563733	.629457	.922679	.317794	.250550
1.51	.564700	.627723	.921611	.318886	.250851
1.52	.565677	.625973	.920536	.319990	.251156
1.53	.566664	.624209	.919452	.321108	.251462
1.54	.567661	.622429	.918361	.322239	.251772
1.55	.568668	.620634	.917261	.323384	.252085
1.56	.569686	.618823	.916153	.324542	.252400
1.57	.570714	.616996	.915037	.325714	.252718
1.58	.571752	.615154	.913913	.326901	.253040
1.59	.572801	.613296	.912781	.328101	.253364
1.60	.573861	.611423	.911641	.329316	.253691
1.61	.574931	.609533	.910492	.330546	.254021
1.62	.576012	.607627	.909335	.331790	.254354
1.63	.577104	.605705	.908170	.333049	.254690
1.64	.578207	.603766	.906997	.334323	.255029
1.65	.579321	.601812	.905815	.335613	.255371
1.66	.580446	.599840	.904625	.336918	.255716
1.67	.581583	.597853	.903427	.338239	.256064
1.68	.582731	.595848	.902220	.339576	.256415
1.69	.583891	.593826	.901005	.340929	.256769
1.70	.585062	.591788	.899781	.342298	.257126
1.71	.586245	.589732	.898549	.343684	.257487
1.72	.587440	.587660	.897308	.345086	.257851
1.73	.588648	.585570	.896060	.346506	.258218
1.74	.589867	.583462	.894802	.347943	.258588
1.75	.591098	.581337	.893536	.349397	.258961
1.76	.592342	.579194	.892261	.350869	.259338
1.77	.593598	.577034	.890978	.352359	.259717
1.78	.594868	.574855	.889686	.353867	.260101
1.79	.596149	.572659	.888386	.355394	.260487
1.80	.597444	.570444	.887077	.356939	.260877
1.81	.598752	.568211	.885759	.358504	.261271
1.82	.600073	.565960	.884432	.360087	.261667
1.83	.601407	.563689	.883097	.361690	.262068
1.84	.602754	.561401	.881753	.363313	.262471
1.85	.604116	.559093	.880400	.364956	.262878
1.86	.605491	.556766	.879038	.366619	.263289
1.87	.606879	.554420	.877667	.368302	.263703
1.88	.608282	.552055	.876288	.370007	.264121
1.89	.609699	.549670	.874899	.371733	.264543

TABLE I (Continued)
COMPRESSION

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S^2}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
1.90	0.611131	0.547266	0.873502	0.373480	0.334965
1.91	.612576	.544842	.872095	.375250	.335396
1.92	.614037	.542398	.870680	.377041	.335829
1.93	.615512	.539933	.869255	.378853	.336265
1.94	.617002	.537449	.867822	.380692	.336705
1.95	.618508	.534944	.866379	.382552	.337148
1.96	.620028	.532419	.864927	.384435	.337596
1.97	.621565	.529872	.863466	.386343	.338047
1.98	.623117	.527305	.861996	.388274	.338502
1.99	.624684	.524717	.860517	.390230	.338961
2.00	.626268	.522107	.859028	.392211	.339424
2.01	.627868	.519476	.857530	.394218	.339891
2.02	.629484	.516823	.856023	.396250	.340362
2.03	.631117	.514149	.854506	.398309	.340837
2.04	.632767	.511452	.852980	.400393	.341316
2.05	.634433	.508733	.851444	.402505	.341799
2.06	.636117	.505992	.849899	.404645	.342286
2.07	.637818	.503228	.848345	.406812	.342778
2.08	.639537	.500441	.846781	.409007	.343274
2.09	.641273	.497631	.845207	.411231	.343775
2.10	.643028	.494798	.843624	.413485	.344280
2.11	.644800	.491942	.842031	.415768	.344786
2.12	.646592	.489062	.840429	.418081	.345299
2.13	.648401	.486157	.838816	.420424	.345816
2.14	.650230	.483229	.837194	.422799	.346338
2.15	.652078	.480276	.835562	.425206	.346864
2.16	.653945	.477299	.833921	.427644	.347394
2.17	.655832	.474297	.832269	.430116	.347929
2.18	.657739	.471270	.830608	.432620	.348469
2.19	.659666	.468217	.828937	.435159	.349013
2.20	.661613	.465139	.827256	.437732	.349562
2.21	.663581	.462036	.825564	.440339	.350116
2.22	.665570	.458906	.823862	.442983	.350674
2.23	.667579	.455749	.822151	.445662	.351237
2.24	.669611	.452566	.820429	.448378	.351805
2.25	.671664	.449357	.818697	.451132	.352378
2.26	.673739	.446120	.816955	.453924	.352956
2.27	.675836	.442855	.815203	.456754	.353539
2.28	.677956	.439563	.813440	.459624	.354127
2.29	.680099	.436243	.811667	.462534	.354719
2.30	.682265	.432895	.809884	.465485	.355317
2.31	.684454	.429518	.808090	.468478	.355920
2.32	.686668	.426112	.806286	.471512	.356529
2.33	.688905	.422677	.804471	.474590	.357142
2.34	.691167	.419212	.802645	.477712	.357761
2.35	.693454	.415718	.800809	.480878	.358385
2.36	.695766	.412193	.798963	.484090	.359014
2.37	.698103	.408638	.797105	.487348	.359649
2.38	.700466	.405051	.795237	.490653	.360290
2.39	.702856	.401434	.793358	.494006	.360936
2.40	.705272	.397785	.791468	.497409	.361587

TABLE I (Continued)
COMPRESSION

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
2.41	.707715	.394104	.789567	.500861	.312245
2.42	.710186	.390391	.787655	.504363	.312908
2.43	.712684	.386645	.785733	.507918	.313576
2.44	.715210	.382866	.783799	.511525	.314251
2.45	.717765	.379053	.781854	.515186	.314931
2.46	.720349	.375207	.779898	.518902	.315619
2.47	.722962	.371326	.777930	.522674	.316310
2.48	.725605	.367411	.775952	.526503	.317008
2.49	.728279	.363461	.773962	.530390	.317713
2.50	.730983	.359475	.771961	.534336	.318423
2.51	.733718	.355453	.769948	.538342	.319140
2.52	.736485	.351394	.767924	.542410	.319863
2.53	.739284	.347299	.765888	.546541	.320593
2.54	.742116	.343167	.763841	.550736	.321328
2.55	.744980	.338996	.761782	.554996	.322071
2.56	.747879	.334788	.759712	.559323	.322820
2.57	.750812	.330540	.757629	.563718	.323575
2.58	.753779	.326253	.755535	.568183	.324336
2.59	.756781	.321927	.753429	.572718	.325107
2.60	.759820	.317560	.751311	.577326	.325882
2.61	.762894	.313152	.749181	.582008	.326665
2.62	.766006	.308703	.747040	.586765	.327455
2.63	.769155	.304211	.744885	.591600	.328252
2.64	.772342	.299678	.742719	.596513	.329055
2.65	.775568	.295101	.740541	.601506	.329866
2.66	.778834	.290480	.738350	.606582	.330685
2.67	.782139	.285815	.736147	.611742	.331510
2.68	.785485	.281105	.733931	.616987	.332343
2.69	.788873	.276349	.731703	.622320	.333184
2.70	.792302	.271547	.729462	.627743	.334032
2.71	.795775	.266699	.727209	.633257	.334888
2.72	.799290	.261802	.724943	.638865	.335751
2.73	.802850	.256858	.722665	.644569	.336622
2.74	.806455	.251864	.720373	.650370	.337501
2.75	.810106	.246820	.718069	.656272	.338389
2.76	.813803	.241727	.715751	.662276	.339284
2.77	.817548	.236581	.713421	.668385	.340187
2.78	.821341	.231384	.711078	.674600	.341099
2.79	.825182	.226134	.708721	.680926	.342019
2.80	.829074	.220831	.706351	.687364	.342947
2.81	.833017	.215473	.703968	.693917	.343885
2.82	.837011	.210060	.701571	.700587	.344830
2.83	.841057	.204590	.699161	.707378	.345785
2.84	.845158	.199064	.696737	.714292	.346748
2.85	.849313	.193479	.694300	.721332	.347720
2.86	.853523	.187836	.691849	.728502	.348701
2.87	.857790	.182133	.689384	.735804	.349691
2.88	.862115	.176369	.686906	.743242	.350691
2.89	.866498	.170543	.684413	.750819	.351699

TABLE I (continued)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S^2}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2 C^2}{\left(\frac{EI}{L}\right)^2}$
2.90	0.870941	0.164654	0.681906	0.758539	0.352718
2.91	.875446	.158701	.679386	.766406	.353746
2.92	.880012	.152683	.676850	.774421	.354783
2.93	.884642	.146599	.674301	.782591	.355830
2.94	.889336	.140448	.671738	.790919	.356888
2.95	.894096	.134228	.669160	.799408	.357955
2.96	.898923	.127939	.666567	.808063	.359032
2.97	.903819	.121579	.663960	.816888	.360119
2.98	.908784	.115147	.661338	.825889	.361218
2.99	.913821	.108641	.658702	.835068	.362326
3.00	.918930	.102060	.656050	.844432	.363444
3.01	.924113	.0954039	.653384	.853985	.364575
3.02	.929372	.0886698	.650701	.863732	.365715
3.03	.934708	.0818565	.648005	.873679	.366866
3.04	.940123	.0749633	.645292	.883830	.368028
3.05	.945618	.0679879	.642565	.894193	.369203
3.06	.951195	.0609290	.639822	.904772	.370389
3.07	.956856	.0537850	.637063	.915573	.371585
3.08	.962603	.0465543	.634289	.926604	.372793
3.09	.968437	.0392350	.631499	.937870	.374014
3.10	.974360	.0318257	.628694	.949376	.375248
3.11	.980375	.0243243	.625872	.961135	.376491
3.12	.986485	.0167291	.623035	.973149	.377749
3.13	.992687	.00903818	.620182	.985427	.379021
3.14	.998987	.00124960	.617312	.997976	.380216.
π	1.00000	0	.616850	1.00000	.380504
3.15	1.00539	-.00663866	.614429	1.01080	.381602
3.16	1.01189	-.0146287	.611520	1.02392	.382903
3.17	1.01850	-.0227226	.608598	1.03734	.384221
3.18	1.02521	-.0309225	.605663	1.05106	.385556
3.19	1.03203	-.0392308	.602708	1.06509	.386902
3.20	1.03897	-.0476498	.599738	1.07945	.388263
3.21	1.04601	-.0561816	.596750	1.09416	.389637
3.22	1.05316	-.0648294	.593745	1.10919	.391026
3.23	1.06046	-.0735951	.590723	1.12458	.392428
3.24	1.06787	-.0824816	.587683	1.14035	.393844
3.25	1.07541	-.0914915	.584625	1.15650	.395275
3.26	1.08307	-.100628	.581551	1.17303	.396721
3.27	1.09086	-.109893	.578459	1.18998	.398183
3.28	1.09879	-.119290	.575348	1.20734	.399658
3.29	1.10686	-.128823	.572218	1.22513	.401149
3.30	1.11506	-.138494	.569072	1.24337	.402656
3.31	1.12342	-.148307	.565906	1.26207	.404178
3.32	1.13192	-.158266	.562723	1.28125	.405716
3.33	1.14058	-.168372	.559520	1.30092	.407270
3.34	1.14939	-.178632	.556299	1.32111	.408841
3.35	1.15837	-.189047	.553058	1.34182	.410427
3.36	1.16751	-.199622	.549799	1.36308	.412031
3.37	1.17682	-.210362	.546521	1.38491	.413652
3.38	1.18631	-.221270	.543223	1.40733	.415290
3.39	1.19597	-.232350	.539905	1.43035	.416945
3.40	1.20582	-.243607	.536569	1.45401	.418618

TABLE I (continued)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2 C^2}{\left(\frac{EI}{L}\right)^2}$
3.41	1.21586	-.255047	.533212	1.47832	.420309
3.42	1.22610	-.266675	.529835	1.50331	.422018
3.43	1.23653	-.278491	.526438	1.52901	.423746
3.44	1.24717	-.290505	.523021	1.55544	.425492
3.45	1.25802	-.302722	.519584	1.58262	.427257
3.46	1.26909	-.315147	.516126	1.61060	.429041
3.47	1.28039	-.327785	.512648	1.63940	.430846
3.48	1.29192	-.340644	.509148	1.66905	.432670
3.49	1.30368	-.353728	.505627	1.69958	.434514
3.50	1.31569	-.367045	.502085	1.73104	.436378
3.51	1.32795	-.380602	.498522	1.76346	.438262
3.52	1.34048	-.394405	.494937	1.79688	.440168
3.53	1.35327	-.408463	.491330	1.83134	.442095
3.54	1.36634	-.422782	.487701	1.86689	.444044
3.55	1.37970	-.437371	.484051	1.90356	.446014
3.56	1.39335	-.452238	.480377	1.94142	.448007
3.57	1.40731	-.467392	.476682	1.98051	.450022
3.58	1.42158	-.482841	.472963	2.02089	.452061
3.59	1.43618	-.498597	.469222	2.06260	.454122
3.60	1.45111	-.514668	.465457	2.10572	.456207
3.61	1.46639	-.531064	.461670	2.15031	.458315
3.62	1.48204	-.547798	.457859	2.19643	.460448
3.63	1.49805	-.564879	.454024	2.24416	.462606
3.64	1.51445	-.582321	.450165	2.29357	.464789
3.65	1.53126	-.600135	.446282	2.34474	.466997
3.66	1.54847	-.618335	.442375	2.39776	.469231
3.67	1.56612	-.636934	.438443	2.45272	.471491
3.68	1.58420	-.655946	.434486	2.50971	.473778
3.69	1.60276	-.675387	.430505	2.56883	.476091
3.70	1.62179	-.695273	.426498	2.63019	.478432
3.71	1.64131	-.715619	.422465	2.69391	.480801
3.72	1.66136	-.736445	.418407	2.76011	.483199
3.73	1.68194	-.757767	.414323	2.82893	.485625
3.74	1.70308	-.779606	.410213	2.90049	.488080
3.75	1.72480	-.801982	.406077	2.97495	.490565
3.76	1.74713	-.824916	.401914	3.05247	.493080
3.77	1.77009	-.848432	.397723	3.13322	.495625
3.78	1.79371	-.872553	.393506	3.21738	.498202
3.79	1.81801	-.897304	.389261	3.30514	.500810
3.80	1.84302	-.922712	.384989	3.39672	.503451
3.81	1.86878	-.948807	.380689	3.49234	.506124
3.82	1.89532	-.975617	.376360	3.59224	.508830
3.83	1.92268	-1.00318	.372003	3.69669	.511570
3.84	1.95088	-1.03151	.367617	3.80595	.514345
3.85	1.97998	-1.06067	.363202	3.92034	.517154
3.86	2.01002	-1.09069	.358758	4.04017	.519999
3.87	2.04103	-1.12159	.354284	4.16581	.522879
3.88	2.07307	-1.15344	.349780	4.29763	.525797

TABLE I (continued)

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
3.89	2.10619	-1.18628	0.345245	4.43605	0.528752
3.90	2.14045	-1.22015	.340650	4.58151	.531744
3.91	2.17589	-1.25511	.336085	4.73450	.534775
3.92	2.21259	-1.29121	.331458	4.89555	.537846
3.93	2.25061	-1.32852	.326799	5.06524	.540956
3.94	2.29002	-1.36709	.322109	5.24419	.544107
3.95	2.33090	-1.40701	.317386	5.43311	.547299
3.96	2.37334	-1.44834	.312631	5.63273	.550533
3.97	2.41741	-1.49116	.307843	5.84386	.553810
3.98	2.46323	-1.53556	.303022	6.06745	.557130
3.99	2.51085	-1.58163	.298167	6.30452	.560495
4.00	2.56049	-1.62948	.293279	6.55610	.563905
4.01	2.61217	-1.67922	.288355	6.82343	.567361
4.02	2.66606	-1.73096	.283398	7.10787	.570863
4.03	2.72230	-1.78482	.278405	7.41090	.574413
4.04	2.78104	-1.84097	.273376	7.73418	.578011
4.05	2.84246	-1.89953	.268312	8.07955	.581659
4.06	2.90673	-1.96069	.263212	8.44909	.585356
4.07	2.97407	-2.02462	.258076	8.84510	.589105
4.08	3.04469	-2.09153	.252900	9.27016	.592906
4.09	3.11885	-2.16163	.247687	9.72720	.596760
4.10	3.19680	-2.23517	.242439	10.2195	.600668
4.11	3.27885	-2.31241	.237151	10.7508	.604631
4.12	3.36532	-2.39366	.231824	11.3254	.608650
4.13	3.45656	-2.47924	.226457	11.9479	.612726
4.14	3.55304	-2.56952	.221051	12.6241	.616861
4.15	3.65515	-2.66491	.215605	13.3602	.621054
4.16	3.76343	-2.76587	.210118	14.1634	.625308
4.17	3.87843	-2.87290	.204590	15.0422	.629624
4.18	4.00082	-2.98660	.199020	16.0065	.634003
4.19	4.13130	-3.10762	.193408	17.0677	.638445
4.20	4.27073	-3.23670	.187753	18.2391	.642953
4.21	4.42004	-3.37471	.182055	19.5367	.647527
4.22	4.58031	-3.52261	.176313	20.9793	.652170
4.23	4.75260	-3.68159	.170527	22.5891	.656881
4.24	4.93815	-3.85278	.164696	24.3933	.661663
4.25	5.14045	-4.03787	.158820	26.4243	.666517
4.26	5.35927	-4.23858	.152897	28.7218	.671445
4.27	5.59774	-4.45701	.146928	31.3347	.676448
4.28	5.85841	-4.69564	.140912	34.3233	.681527
4.29	6.14520	-4.95746	.134847	37.7634	.686684
4.30	6.46148	-5.24604	.128735	41.7508	.691921
4.31	6.81233	-5.56579	.122573	46.4079	.697240
4.32	7.20372	-5.92207	.116362	51.8937	.702641
4.33	7.64310	-6.32159	.110100	58.4179	.708127
4.34	8.13984	-6.77281	.103787	66.2570	.713700
4.35	8.70595	-7.28654	.0974220	75.7936	.719361
4.36	9.35704	-7.87684	.0910048	87.5541	.725112
4.37	10.1157	-8.56231	.0845344	102.288	.730955
4.38	11.0040	-9.36812	.0780101	121.089	.736893
4.39	12.0666	-10.3292	.0714311	145.603	.742927
4.40	13.3569	-11.4953	.0647967	178.406	.749059

TABLE I (continued)

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
4.41	14.9567	-12.9404	.0581061	223.703	.755292
4.42	16.9926	-14.7783	.0513585	288.747	.761627
4.43	19.6708	-17.1948	.0445531	386.939	.768067
4.44	23.3522	-20.5151	.0376891	545.324	.774615
4.45	28.7300	-25.3636	.0307656	825.413	.781272
4.46	37.3277	-33.1126	.0237817	1393.35	.788041
4.47	53.2714	-47.4793	.0167367	2837.84	.794925
4.48	92.9960	-83.2686	.00962948	8648.26	.801926
4.49	365.751	-328.980	.00245924	133774	.809047
4.50	-189.213	170.947	-.00477492	35801.6	.816291
4.51	-75.1653	68.2048	-.0120741	5649.83	.823660
4.52	-46.8989	42.7873	-.0194392	2199.51	.831158
4.53	-34.0830	31.1882	-.0268713	1161.65	.838787
4.54	-26.7689	24.5953	-.0343712	716.677	.846551
4.55	-22.0401	20.3312	-.0419402	485.765	.854452
4.56	-18.7317	17.3467	-.0495793	350.878	.862495
4.57	-16.2875	15.1406	-.0572895	265.283	.870682
4.58	-14.4080	13.4433	-.0650721	207.590	.879016
4.59	-12.9178	12.0966	-.0729281	166.871	.887502
4.60	-11.7074	11.0020	-.0808587	137.064	.896148
4.61	-10.7048	10.0945	-.0888651	114.593	.904943
4.62	-9.86073	9.32975	-.0969487	97.2340	.913906
4.63	-9.14036	8.67647	-.105110	83.5462	.923036
4.64	-8.51839	8.11180	-.113352	72.5638	.932337
4.65	-7.97597	7.61877	-.121674	63.6161	.941813
4.66	-7.49878	7.18447	-.130079	56.2316	.951469
4.67	-7.07572	6.79892	-.138567	50.0659	.961309
4.68	-6.69811	6.45429	-.147141	44.8647	.971338
4.69	-6.35901	6.14431	-.155801	40.4370	.981561
4.70	-6.05282	5.86397	-.164549	36.6367	.991984
4.71	-5.77499	5.60914	-.173386	33.3506	1.00261
4.72	-5.52177	5.37645	-.182315	30.4899	1.01346
4.73	-5.29003	5.16309	-.191336	27.9844	1.02450
4.74	-5.07716	4.96671	-.200452	25.7775	1.03577
4.75	-4.88096	4.78531	-.209664	23.8237	1.04727
4.76	-4.69954	4.61722	-.218974	22.0857	1.05900
4.77	-4.53132	4.46097	-.228383	20.5329	1.07097
4.78	-4.37490	4.31534	-.237894	19.1398	1.08318
4.79	-4.22910	4.17924	-.247507	17.8853	1.09565
4.80	-4.09288	4.05174	-.257227	16.7516	1.10838
4.81	-3.96532	3.93202	-.267053	15.7237	1.12137
4.82	-3.84563	3.81937	-.276988	14.7889	1.13464
4.83	-3.73312	3.71315	-.287035	13.9362	1.14819
4.84	-3.62716	3.61280	-.297196	13.1563	1.16203
4.85	-3.52721	3.51784	-.307471	12.4412	1.17617
4.86	-3.43276	3.42781	-.317865	11.7839	1.19062
4.87	-3.34339	3.34252	-.328379	11.1782	1.20538
4.88	-3.25869	3.26102	-.339015	10.6191	1.22047

TABLE I (continued)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
4.89	-3.17635	3.18358	-0.349777	10.1018	1.23589
4.90	-3.10197	3.10973	-.360666	9.62219	1.25165
4.91	-3.02932	3.03919	-.371685	9.17680	1.26777
4.92	-2.96014	2.97175	-.382837	8.76244	1.28426
4.93	-2.89418	2.90717	-.394124	8.37628	1.30112
4.94	-2.83122	2.84527	-.405550	8.01563	1.31837
4.95	-2.77108	2.78587	-.417117	7.67886	1.33602
4.96	-2.71356	2.72880	-.428829	7.36339	1.35405
4.97	-2.65850	2.67393	-.440687	7.06763	1.37257
4.98	-2.60576	2.62110	-.452697	6.78997	1.39150
4.99	-2.55519	2.57020	-.464860	6.52898	1.41088
5.00	-2.50666	2.52111	-.477180	6.28335	1.43073
5.01	-2.46006	2.47373	-.489661	6.05191	1.45106
5.02	-2.41528	2.42794	-.502307	5.83356	1.47188
5.03	-2.37222	2.38367	-.515120	5.62741	1.49323
5.04	-2.33077	2.34083	-.528106	5.43251	1.51510
5.05	-2.29087	2.29934	-.541267	5.24807	1.53752
5.06	-2.25241	2.25912	-.554607	5.07337	1.56052
5.07	-2.21534	2.22011	-.568132	4.90774	1.58409
5.08	-2.17958	2.18225	-.581845	4.75057	1.60828
5.09	-2.14506	2.14547	-.595752	4.60129	1.63309
5.10	-2.11173	2.10973	-.609855	4.45939	1.65855
5.11	-2.07952	2.07496	-.624161	4.32440	1.68469
5.12	-2.04838	2.04112	-.638675	4.19587	1.71152
5.13	-2.01827	2.00817	-.653400	4.07341	1.73907
5.14	-1.98913	1.97606	-.668344	3.95665	1.76737
5.15	-1.96093	1.94475	-.683511	3.84523	1.79644
5.16	-1.93361	1.91420	-.698906	3.73885	1.82632
5.17	-1.90715	1.88436	-.714536	3.63721	1.85702
5.18	-1.88150	1.85524	-.730408	3.54004	1.88859
5.19	-1.85663	1.82681	-.746526	3.44707	1.92106
5.20	-1.83251	1.79898	-.762898	3.35809	1.95445
5.21	-1.80910	1.77176	-.779531	3.27286	1.98881
5.22	-1.78639	1.74513	-.796432	3.19118	2.02416
5.23	-1.76433	1.71904	-.813607	3.11286	2.06058
5.24	-1.74291	1.69349	-.831065	3.03773	2.09807
5.25	-1.72210	1.66844	-.848813	2.96561	2.13668
5.26	-1.70187	1.64388	-.866860	2.89636	2.17646
5.27	-1.68221	1.61978	-.885214	2.82983	2.21746
5.28	-1.66309	1.59614	-.903884	2.76586	2.25973
5.29	-1.64449	1.57292	-.922879	2.70436	2.30332
5.30	-1.62640	1.55011	-.942210	2.64518	2.34826
5.31	-1.60880	1.52769	-.961884	2.58823	2.39468
5.32	-1.59166	1.50565	-.981914	2.53338	2.44258
5.33	-1.57498	1.48398	-1.00231	2.48056	2.49203
5.34	-1.55873	1.46266	-1.02306	2.42965	2.54311
5.35	-1.54291	1.44166	-1.04424	2.38057	2.59589
5.36	-1.52750	1.42098	-1.06581	2.33325	2.65044
5.37	-1.51248	1.40062	-1.08778	2.28759	2.70685
5.38	-1.49784	1.38055	-1.11019	2.24353	2.76519
5.39	-1.48356	1.36077	-1.13303	2.20100	2.82557
5.40	-1.46967	1.34126	-1.15634	2.15993	2.88807

TABLE I (continued)

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2 C^2}{\left(\frac{EI}{L}\right)^2}$
5.41	-1.43611	1.32292	-1.18011	2.12925	2.75278
5.42	-1.44289	1.30303	-1.20437	2.08192	3.01983
5.43	-1.42999	1.28426	-1.22913	2.04487	3.28931
5.44	-1.41741	1.26577	-1.25442	2.00985	3.56136
5.45	-1.40514	1.24748	-1.28024	1.97441	3.83609
5.46	-1.39316	1.22940	-1.30662	1.94090	4.11363
5.47	-1.38148	1.21154	-1.33358	1.90848	4.39414
5.48	-1.37008	1.19387	-1.36115	1.87711	4.67775
5.49	-1.35895	1.17640	-1.38935	1.84674	4.96465
5.50	-1.34809	1.15911	-1.41816	1.81733	5.25498
5.51	-1.33748	1.14200	-1.44766	1.78886	5.54894
5.52	-1.32713	1.12506	-1.47785	1.76125	5.84673
5.53	-1.31703	1.10828	-1.50877	1.73456	6.14854
5.54	-1.30716	1.09166	-1.54044	1.70867	6.45461
5.55	-1.29753	1.07519	-1.57289	1.68358	6.76516
5.56	-1.28812	1.05887	-1.60616	1.65924	7.08047
5.57	-1.27894	1.04269	-1.64027	1.63566	7.40079
5.58	-1.26997	1.02664	-1.67527	1.61282	7.72641
5.59	-1.26121	1.01071	-1.71119	1.59065	8.05767
5.60	-1.25266	.994918	-1.74806	1.56915	8.39489
5.61	-1.24431	.979230	-1.78594	1.54830	8.73843
5.62	-1.23615	.963660	-1.82487	1.52807	9.08870
5.63	-1.22819	.948196	-1.86489	1.50845	9.44609
5.64	-1.22041	.932838	-1.90605	1.48941	9.81108
5.65	-1.21282	.917677	-1.94842	1.47093	10.18416
5.66	-1.20541	.902410	-1.99204	1.45301	10.56585
5.67	-1.19817	.887332	-2.03697	1.43561	10.95674
5.68	-1.19111	.872339	-2.08329	1.41873	11.35744
5.69	-1.18421	.857427	-2.13106	1.40235	11.76864
5.70	-1.17748	.842593	-2.18036	1.38645	12.19107
5.71	-1.17090	.827831	-2.23124	1.37102	12.62554
5.72	-1.16449	.813139	-2.28382	1.35604	13.07290
5.73	-1.15824	.798512	-2.33818	1.34151	13.53415
5.74	-1.15213	.783947	-2.39441	1.32741	14.01031
5.75	-1.14618	.769440	-2.45263	1.31372	14.50253
5.76	-1.14037	.754987	-2.51293	1.30044	15.01206
5.77	-1.13471	.740586	-2.57545	1.28756	15.54029
5.78	-1.12918	.726233	-2.64031	1.27506	16.08875
5.79	-1.12380	.711924	-2.70766	1.26293	16.65909
5.80	-1.11856	.697656	-2.77765	1.25117	17.25319
5.81	-1.11345	.683427	-2.85045	1.23976	17.87311
5.82	-1.10847	.669232	-2.92623	1.22870	18.52111
5.83	-1.10362	.655069	-3.00519	1.21798	19.19998
5.84	-1.09890	.640934	-3.08755	1.20759	19.91199
5.85	-1.09431	.626825	-3.17354	1.19752	20.66006
5.86	-1.08984	.612739	-3.26342	1.18776	21.44695
5.87	-1.08550	.598672	-3.35747	1.17831	22.27626
5.88	-1.08128	.584623	-3.45599	1.16916	23.15144

TABLE I (concluded)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
5.89	-1.07716	0.570587	-3.55933	1.16031	14.6996
5.90	-1.07319	.556562	-3.66787	1.15174	15.4946
5.91	-1.06932	.542546	-3.78201	1.14345	16.3555
5.92	-1.06557	.528535	-3.90222	1.13544	17.2898
5.93	-1.06193	.514527	-4.02902	1.12771	18.3061
5.94	-1.05841	.500518	-4.16298	1.12023	19.4140
5.95	-1.05500	.486507	-4.30474	1.11302	20.6250
5.96	-1.05169	.472491	-4.45502	1.10606	21.9521
5.97	-1.04850	.458466	-4.61463	1.09935	23.4105
5.98	-1.04541	.444431	-4.78450	1.09289	25.0178
5.99	-1.04244	.430382	-4.96569	1.08667	26.7953
6.00	-1.03956	.416317	-5.15938	1.08069	28.7671
6.01	-1.03680	.402234	-5.36694	1.07495	30.9628
6.02	-1.03413	.388129	-5.58995	1.06943	33.4171
6.03	-1.03158	.373999	-5.83026	1.06415	36.1724
6.04	-1.02912	.359843	-6.08996	1.05909	39.2790
6.05	-1.02677	.345658	-6.37157	1.05425	42.7993
6.06	-1.02452	.331441	-6.67802	1.04963	46.8093
6.07	-1.02236	.317189	-7.01282	1.04523	51.4041
6.08	-1.02031	.302899	-7.38013	1.04104	56.7018
6.09	-1.01837	.288570	-7.78502	1.03707	62.8631
6.10	-1.01651	.274197	-8.23357	1.03330	70.0494
6.11	-1.01476	.259780	-8.73351	1.02975	78.5430
6.12	-1.01311	.245314	-9.29412	1.02639	88.6607
6.13	-1.01156	.230797	-9.92736	1.02325	100.844
6.14	-1.01010	.216227	-10.6483	1.02031	115.688
6.15	-1.00874	.201600	-11.4768	1.01757	134.031
6.16	-1.00749	.186914	-12.4392	1.01503	157.058
6.17	-1.00632	.172166	-13.5707	1.01269	184.501
6.18	-1.00526	.157353	-14.9205	1.01055	224.970
6.19	-1.00429	.142472	-16.5591	1.00860	276.565
6.20	-1.00342	.127521	-18.5908	1.00686	347.990
6.21	-1.00265	.112495	-21.1758	1.00531	450.798
6.22	-1.00198	.0973934	-24.5774	1.00396	606.443
6.23	-1.00140	.0822118	-29.2572	1.00281	858.388
6.24	-1.00093	.0669474	-36.1065	1.00185	1306.24
6.25	-1.00055	.0515970	-47.0647	1.00110	2217.51
6.26	-1.00027	.0361576	-67.4745	1.00054	4555.25
6.27	-1.00009	.0206258	-118.606	1.00017	14117.2
6.28	-1.00001	.00499841	-490.041	1.00001	240142
2π	-1.00000	0	$-\infty$	1.00000	∞

TABLE II
TENSION

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
0	0.500000	0.750000	1.00000	0.250000	0.250000
.1	.499757	.750512	1.00036	.249757	.249936
.2	.499001	.751998	1.00133	.249002	.249665
.3	.497760	.754488	1.00300	.247765	.249251
.4	.496033	.757964	1.00532	.246049	.248675
.5	.493831	.762412	1.00831	.243869	.247937
.6	.491167	.767818	1.01194	.241245	.247042
.7	.488057	.774165	1.01623	.238200	.245994
.8	.484519	.781431	1.02116	.234759	.244798
.9	.480575	.789595	1.02672	.230953	.243459
1.0	.476246	.798632	1.03291	.226810	.241983
1.1	.471556	.808515	1.03971	.222365	.240376
1.2	.466530	.819215	1.04712	.217651	.238646
1.3	.461194	.830703	1.05513	.212700	.236797
1.4	.455575	.842949	1.06372	.207548	.234843
1.5	.449699	.855921	1.07289	.202229	.232785
1.6	.443594	.869586	1.08262	.196775	.230633
1.7	.437286	.883915	1.09290	.191219	.228396
1.8	.430802	.898873	1.10371	.185590	.226081
1.9	.424167	.914427	1.11505	.179916	.223697
2.0	.417408	.930553	1.12689	.174229	.221251
2.1	.410548	.947214	1.13923	.168550	.218751
2.2	.403610	.964380	1.15205	.162901	.216205
2.3	.396616	.982024	1.16534	.157305	.213621
2.4	.389588	1.00012	1.17908	.151779	.211006
2.5	.382544	1.01863	1.19325	.146340	.208366
2.6	.375502	1.03754	1.20785	.141002	.205709
2.7	.368480	1.05683	1.22287	.135777	.203042
2.8	.361492	1.07646	1.23827	.130677	.200369
2.9	.354553	1.09642	1.25406	.125708	.197697
3.0	.347676	1.11665	1.27022	.120878	.195032
3.1	.340871	1.13722	1.28673	.116193	.192376
3.2	.334149	1.15803	1.30358	.111656	.189740
3.3	.327520	1.17909	1.32076	.107269	.187122
3.4	.320990	1.20037	1.33826	.103034	.184529
3.5	.314566	1.22188	1.35606	.0989519	.181963
3.6	.308255	1.24358	1.37416	.0950214	.179429
3.7	.302062	1.26547	1.39253	.0912413	.176929
3.8	.295990	1.28754	1.41117	.0876098	.174466
3.9	.290042	1.30976	1.43007	.0841242	.172042
4.0	.284221	1.33214	1.44921	.0807815	.169658
4.1	.278529	1.35466	1.46859	.0775783	.167318
4.2	.272967	1.37731	1.48820	.0745108	.165022
4.3	.267535	1.40009	1.50802	.0715749	.162771
4.4	.262234	1.42297	1.52805	.0687666	.160564
4.5	.257063	1.44597	1.54828	.0660815	.158403
4.6	.252022	1.46907	1.56870	.0635151	.156300
4.7	.247110	1.49225	1.58930	.0610631	.154238
4.8	.242324	1.51553	1.61008	.0587210	.152225
4.9	.237664	1.53889	1.63101	.0564843	.150260
5.0	.233128	1.56232	1.65211	.0543486	.148343

TABLE II (continued)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
5.1	.228713	1.58583	1.67336	.0523097	.146475
5.2	.224418	1.60940	1.69476	.0503634	.144654
5.3	.220239	1.63304	1.71629	.0485064	.142880
5.4	.216176	1.65674	1.73795	.0467319	.141153
5.5	.212224	1.68049	1.75974	.0450386	.139472
5.6	.208381	1.70429	1.78166	.0434225	.137836
5.7	.204645	1.72814	1.80368	.0418794	.136245
5.8	.201012	1.75204	1.82582	.0404059	.134698
5.9	.197481	1.77599	1.84806	.0389987	.133193
6.0	.194048	1.79997	1.87040	.0376547	.131731
6.1	.190711	1.82400	1.89284	.0363706	.130310
6.2	.187466	1.84806	1.91537	.0351437	.128930
6.3	.184312	1.87215	1.93799	.0339710	.127588
6.4	.181245	1.89628	1.96069	.0328499	.126285
6.5	.178264	1.92044	1.98348	.0317779	.125020
6.6	.175364	1.94463	2.00633	.0307526	.123791
6.7	.172544	1.96885	2.02927	.0297715	.122597
6.8	.169802	1.99310	2.05227	.0288326	.121438
6.9	.167134	2.01737	2.07534	.0279336	.120312
7.0	.164539	2.04166	2.09847	.0270730	.119218
7.1	.162013	2.06598	2.12167	.0262484	.118157
7.2	.159556	2.09032	2.14493	.0254582	.117125
7.3	.157164	2.11468	2.16824	.0247007	.116124
7.4	.154836	2.13906	2.19160	.0239743	.115151
7.5	.152570	2.16346	2.21502	.0232775	.114207
7.6	.150363	2.18788	2.23849	.0226089	.113289
7.7	.148213	2.21231	2.26200	.0219671	.112398
7.8	.146119	2.23676	2.28556	.0213507	.111532
7.9	.144079	2.26123	2.30917	.0207586	.110690
8.0	.142090	2.28571	2.33281	.0201897	.109872
8.1	.140152	2.31021	2.35650	.0196427	.109078
8.2	.138262	2.33472	2.38022	.0191167	.108305
8.3	.136421	2.35925	2.40399	.0186107	.107554
8.4	.134625	2.38378	2.42778	.0181238	.106824
8.5	.132872	2.40833	2.45162	.0176550	.106114
8.6	.131162	2.43289	2.47548	.0172035	.105423
8.7	.129494	2.45747	2.49938	.0167686	.104752
8.8	.127865	2.48205	2.52331	.0163495	.104098
8.9	.126275	2.50665	2.54726	.0159454	.103462
9.0	.124722	2.53125	2.57125	.0155557	.102843
9.1	.123206	2.55586	2.59526	.0151797	.102241
9.2	.121724	2.58049	2.61930	.0148169	.101654
9.3	.120277	2.60512	2.64336	.0144666	.101083
9.4	.118862	2.62976	2.66745	.0141283	.100527
9.5	.117480	2.65441	2.69156	.0138015	.0999848
9.6	.116128	2.67907	2.71569	.0134857	.0994567
9.7	.114806	2.70374	2.73985	.0131804	.0989421
9.8	.113513	2.72841	2.76402	.0128852	.0984406
9.9	.112248	2.75309	2.78822	.0125996	.0979515

TABLE III (continued)

$\left(\frac{L}{j}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
10.0	0.111010	2.77778	2.81244	0.0123233	0.0974746
10.1	.109799	2.80247	2.83667	.0120558	.0970094
10.2	.108613	2.82717	2.86092	.0117968	.0965857
10.3	.107452	2.85188	2.88519	.0115460	.0961130
10.4	.106316	2.87660	2.90948	.0113030	.0956810
10.5	.105202	2.90132	2.93379	.0110675	.0952592
10.6	.104112	2.92604	2.95811	.0108392	.0948475
10.7	.103043	2.95077	2.98244	.0106179	.0944454
10.8	.101996	2.97551	3.00679	.0104032	.0940527
10.9	.100969	3.00025	3.03115	.0101948	.0936691
11.0	.0999633	3.02500	3.05553	.00999265	.0932942
11.1	.0989767	3.04975	3.07992	.00979638	.0929279
11.2	.0980092	3.07451	3.10433	.00960580	.0925698
11.3	.0970602	3.09927	3.12875	.00942069	.0922196
11.4	.0961293	3.12404	3.15318	.00924084	.0918773
11.5	.0952169	3.14881	3.17762	.00906607	.0915424
11.6	.0943196	3.17358	3.20207	.00889618	.0912148
11.7	.0934398	3.19836	3.22654	.00873100	.0908943
11.8	.0925762	3.22315	3.25101	.00857036	.0905806
11.9	.0917283	3.24794	3.27550	.00841408	.0902736
12.0	.0908957	3.27273	3.29999	.00826203	.0899730
12.1	.0900780	3.29752	3.32450	.00811404	.0896787
12.2	.0892748	3.32232	3.34901	.00796998	.0893904
12.3	.0884857	3.34712	3.37354	.00782971	.0891081
12.4	.0877103	3.37193	3.39807	.00769310	.0888314
12.5	.0869484	3.39674	3.42261	.00756003	.0885603
12.6	.0861996	3.42155	3.44717	.00743037	.0882947
12.7	.0854635	3.44637	3.47172	.00730400	.0880342
12.8	.0847398	3.47119	3.49629	.00718083	.0877789
12.9	.0840282	3.49601	3.52087	.00706074	.0875285
13.0	.0833284	3.52083	3.54545	.00694363	.0872830
13.1	.0826402	3.54566	3.57004	.00682940	.0870421
13.2	.0819632	3.57049	3.59464	.00671797	.0868058
13.3	.0812972	3.59533	3.61925	.00660923	.0865739
13.4	.0806419	3.62016	3.64386	.00650311	.0863464
13.5	.0799970	3.64500	3.66848	.00639953	.0861230
13.6	.0793624	3.66984	3.69310	.00629839	.0859038
13.7	.0787377	3.69469	3.71773	.00619965	.0856885
13.8	.0781226	3.71953	3.74237	.00610317	.0854771
13.9	.0775174	3.74438	3.76702	.00600895	.0852694
14.0	.0769213	3.76923	3.79167	.00591688	.0850654
14.1	.0763343	3.79408	3.81632	.00582692	.0848651
14.2	.0757561	3.81894	3.84098	.00573899	.0846681
14.3	.0751866	3.84380	3.86565	.00565303	.0844746
14.4	.0746257	3.86866	3.89032	.00556899	.0842845
14.5	.0740730	3.89352	3.91500	.00548681	.0840975
14.6	.0735284	3.91838	3.93968	.00540648	.0839137
14.7	.0729918	3.94325	3.96437	.00532780	.0837330
14.8	.0724630	3.96812	3.98906	.00525088	.0835553
14.9	.0719417	3.99299	4.01376	.00517561	.0833805
15.0	.0714279	4.01786	4.03846	.00510195	.0832085

TABLE II (continued)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
15.1	.0709214	4.04273	4.06317	.00502954	.0830394
15.2	.0704220	4.04761	4.08788	.00495926	.0828729
15.3	.0699296	4.09248	4.11259	.00489015	.0827091
15.4	.0694440	4.11736	4.13731	.00482247	.0825480
15.5	.0689651	4.14224	4.16204	.00475619	.0823893
15.6	.0684926	4.16712	4.18676	.00469126	.0822331
15.7	.0680269	4.19201	4.21150	.00462766	.0820794
15.8	.0675673	4.21689	4.23623	.00456534	.0819280
15.9	.0671138	4.24178	4.26097	.00450427	.0817789
16.0	.0666664	4.24667	4.28571	.00444441	.0816321
16.1	.0662249	4.29156	4.31046	.00438574	.0814874
16.2	.0657893	4.31645	4.33521	.00432823	.0813450
16.3	.0653593	4.34134	4.35996	.00427184	.0812046
16.4	.0649349	4.36623	4.38472	.00421654	.0810664
16.5	.0645160	4.39113	4.40948	.00416231	.0809301
16.6	.0641024	4.41603	4.43425	.00410912	.0807958
16.7	.0636941	4.44092	4.45901	.00405694	.0806634
16.8	.0632910	4.46582	4.48378	.00400575	.0805330
16.9	.0628930	4.49072	4.50856	.00395553	.0804043
17.0	.0624999	4.51562	4.53333	.00390624	.0802775
17.1	.0621117	4.54053	4.55811	.00385787	.0801525
17.2	.0617283	4.56543	4.58289	.00381039	.0800292
17.3	.0613496	4.59034	4.60766	.00376378	.0799077
17.4	.0609756	4.61524	4.63247	.00371802	.0797878
17.5	.0606060	4.64015	4.65724	.00367309	.0796695
17.6	.0602409	4.66506	4.68205	.00362897	.0795528
17.7	.0598802	4.68997	4.70685	.00358564	.0794377
17.8	.0595238	4.71488	4.73165	.00354308	.0793241
17.9	.0591716	4.73979	4.75645	.00350127	.0792121
18.0	.0588235	4.76471	4.78125	.00346020	.0791015
18.1	.0584795	4.78962	4.80606	.00341985	.0789923
18.2	.0581395	4.81455	4.83086	.00338020	.0788846
18.3	.0578034	4.83945	4.85567	.00334124	.0787783
18.4	.0574712	4.86437	4.88049	.00330294	.0786733
18.5	.0571428	4.88929	4.90530	.00326530	.0785697
18.6	.0568182	4.91420	4.93012	.00322830	.0784674
18.7	.0564972	4.93912	4.95494	.00319193	.0783664
18.8	.0561798	4.96405	4.97976	.00315617	.0782667
18.9	.0558659	4.98897	5.00459	.00312100	.0781682
19.0	.0555555	5.01389	5.02941	.00308642	.0780709
19.1	.0552486	5.03881	5.05424	.00305241	.0779748
19.2	.0549450	5.06374	5.07907	.00301896	.0778799
19.3	.0546448	5.08866	5.10390	.00298605	.0777861
19.4	.0543478	5.11359	5.12874	.00295369	.0776935
19.5	.0540540	5.13851	5.15357	.00292184	.0776020
19.6	.0537634	5.16344	5.17841	.00289051	.0775116
19.7	.0534759	5.18837	5.20325	.00285968	.0774223
19.8	.0531915	5.21330	5.22809	.00282933	.0773340
19.9	.0529100	5.23823	5.25293	.00279947	.0772467

TABLE II (concluded)

$\left(\frac{L}{J}\right)_{eff}$	C	$\frac{S''}{\left(\frac{EI}{L}\right)}$	$\frac{S}{\left(\frac{EI}{L}\right)}$	C^2	$\frac{S^2C^2}{\left(\frac{EI}{L}\right)^2}$
20	0.0526816	5.26816	5.27778	0.00277008	0.0771605
21	.0500000	5.51250	5.52632	.00250000	.0763504
22	.0476190	5.76190	5.77500	.00226757	.0756258
23	.0454545	6.01136	6.02381	.00206612	.0749716
24	.0434783	6.26087	6.27273	.00189036	.0743801
25	.0416667	6.51042	6.52174	.00173611	.0738423
26	.0400000	6.76000	6.77083	.00160000	.0733507
27	.0384615	7.00962	7.02000	.00147929	.0727000
28	.0370370	7.25926	7.26923	.00137174	.0724862
29	.0357143	7.50893	7.51852	.00127551	.0721052
30	.0344828	7.75862	7.76786	.00118906	.0717474
31	.0333333	8.00833	8.01724	.00111111	.0714180
32	.0322581	8.25806	8.26667	.00104058	.0711111
33	.0312500	8.50781	8.51613	.000976563	.0708247
34	.0303030	8.75758	8.76563	.000918274	.0705566
35	.0294118	9.00735	9.01515	.000865052	.0703053
36	.0285714	9.25714	9.26471	.000816326	.0700692
37	.0277778	9.50694	9.51429	.000771606	.0698469
38	.0270270	9.75676	9.76389	.000730460	.0696374
39	.0263158	10.0066	10.0135	.000692521	.0694394
40	.0256410	10.2564	10.2632	.000657462	.0692521
41	.0250000	10.5063	10.5128	.000626000	.0690746
42	.0243902	10.7561	10.7625	.000594884	.0689063
43	.0238095	11.0060	11.0122	.000566893	.0687465
44	.0232558	11.2558	11.2619	.000540833	.0685941
45	.0227273	11.5057	11.5116	.000516529	.0684492
46	.0222222	11.7556	11.7614	.000493827	.0683110
47	.0217391	12.0054	12.0111	.000472590	.0681790
48	.0212766	12.2553	12.2609	.000452694	.0680529
49	.0208333	12.5052	12.5106	.000434028	.0679323
50	.0204082	12.7551	12.7604	.000416493	.0678168