Propellers
Aerodynamic Characteristics

Zielonka 2019

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Notation

$C_P = \frac{P}{\rho n^3 D^5}$	–	[-] power coefficient
$C_T = \frac{T}{\rho n^2 D^4}$	–	[-] thrust coefficient
D	–	[m] propeller diameter
$J = \frac{V}{nD}$	–	[-] propeller advance ratio
n	–	[rev/s] propeller revolution speed
P	–	[W] power
Q	–	[N·m] torque
$Q_C = \frac{Q}{\rho V^2 D^3}$	–	[-] torque coefficient
T	–	[N] thrust
$T_C = \frac{T}{\rho V^2 D^2}$	–	[-] thrust coefficient (alternative form)
V	–	[m/s] velocity
$\beta_{0.75}$	–	[deg] propeller blade angle at 0.75 of radius
η	–	[-] propeller efficiency
ρ	–	[kg/m^3] air density

1. Introduction

1.1. Resources

Propellers aerodynamic characteristics data is a combination of data available in [1], [2] and [3].

More propellers characteristics can be found in [4], [5], [6], [7], [8], [9], [10], and [11].

1.2. Thrust Coefficient

Thrust coefficient is given as follows. [1], [2]

$$C_T = \frac{T}{\rho n^2 D^4} \tag{1.1}$$

1.3. Power Coefficient

Power coefficient is given as follows. [1], [2]

$$C_P = \frac{P}{\rho n^3 D^5} \tag{1.2}$$

1.4. Alternative Form of Coefficients

Alternative forms of thrust and torque coefficients were used in NACA Report No. 641. [3]

$$T_C = \frac{T}{\rho V^2 D^2} \tag{1.3}$$

$$Q_C = \frac{Q}{\rho V^2 D^3} \tag{1.4}$$

1.5. Converting Data

During tests described in NACA Report No. 641, the tunnel speed was held substantially constant and varied between 100 and 110 miles per hour. [3]

Knowing that all the propellers had 10 feet diameter and assuming constant speed value of 105 miles per hour data given in NACA Report No. 641 can be converted to the previously described form that was used in other NACA Reports.

Hence propeller advance ratio is given by the following formula. [12], [13]

$$J = \frac{V}{nD} \tag{1.5}$$

then propeller speed is.

$$n = \frac{V}{JD} \tag{1.6}$$

Thrust is given as

$$T = \rho V^2 D^2 T_C \tag{1.7}$$

Substituting equation (1.7) into (1.1) gives

$$C_T = \frac{V^2 T_C}{n^2 D^2} \tag{1.8}$$

Torque is given as

$$Q = \rho V^2 D^3 Q_C \tag{1.9}$$

Knowing that [14]

$$P = 2\pi n Q \tag{1.10}$$

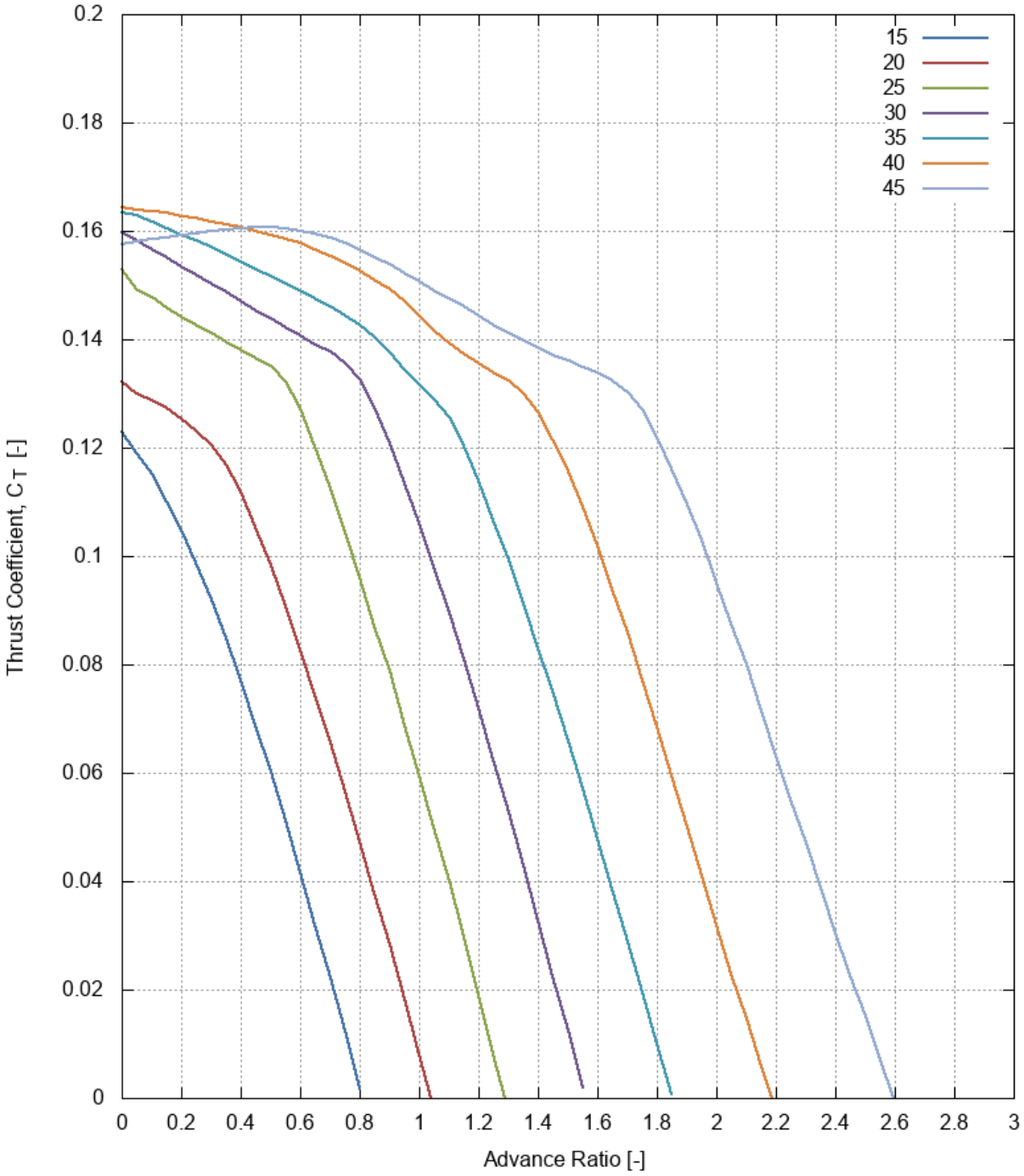
Power is

$$P = 2\pi n \rho V^2 D^3 Q_C \tag{1.11}$$

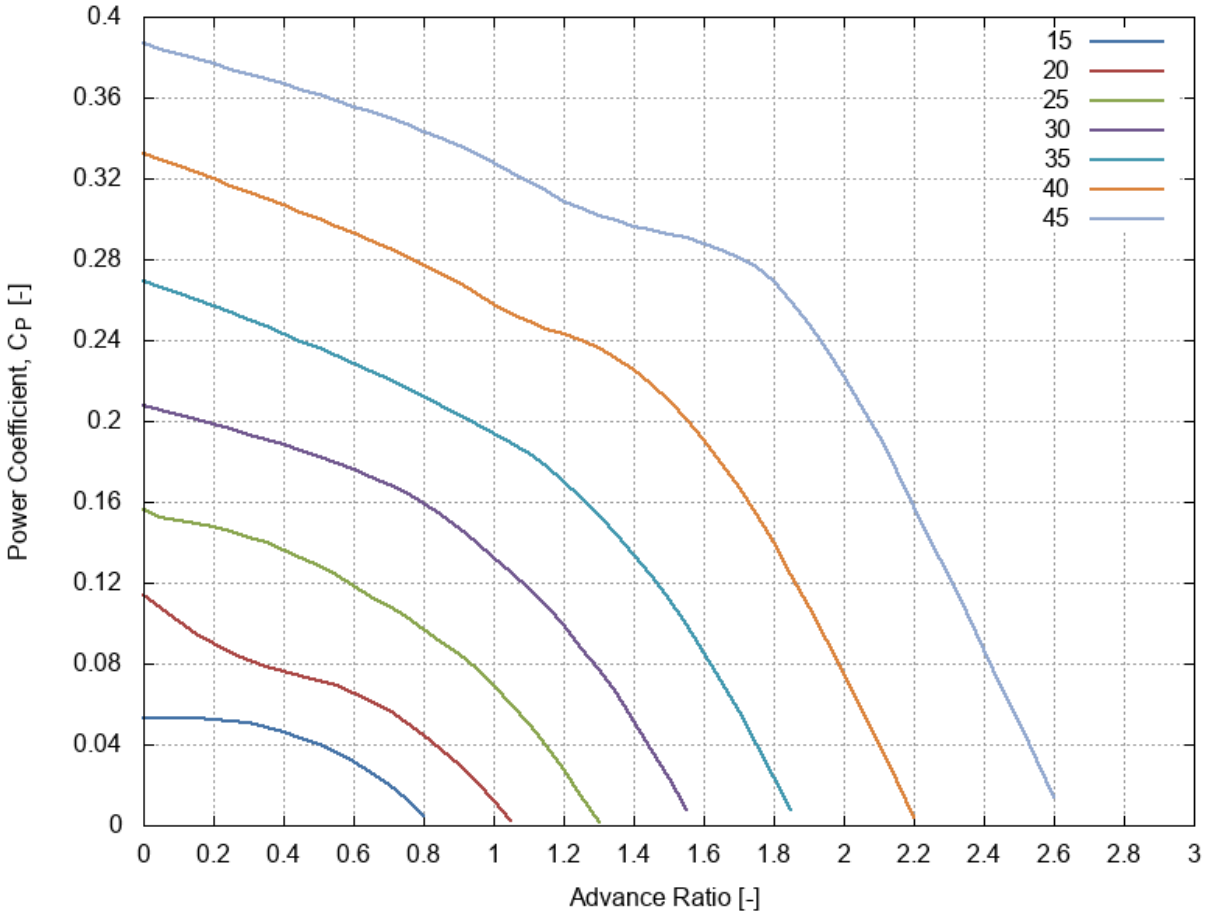
Substituting equation (1.11) into (1.2) gives

$$C_P = \frac{2\pi V^2 Q_C}{n^2 D^2} \tag{1.12}$$

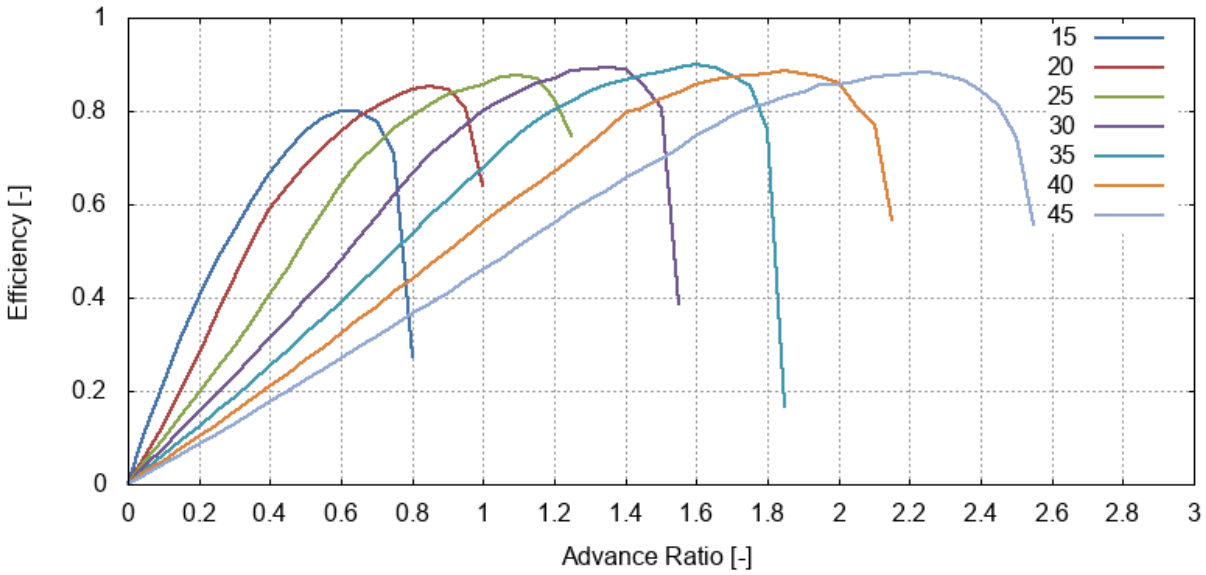
2. Hamilton Standard propeller 1C1-0, 3 blades



Thrust coefficient [1]



Power coefficient [1]



Efficiency [1]

2.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35	40	45
0.00	0.1230	0.1323	0.1529	0.1598	0.1635	0.1643	0.1576
0.05	0.1191	0.1299	0.1492	0.1582	0.1629	0.1640	0.1581
0.10	0.1150	0.1288	0.1477	0.1566	0.1617	0.1637	0.1585
0.15	0.1101	0.1272	0.1459	0.1550	0.1606	0.1633	0.1589
0.20	0.1048	0.1253	0.1442	0.1535	0.1593	0.1628	0.1592
0.25	0.0988	0.1231	0.1427	0.1519	0.1583	0.1624	0.1596
0.30	0.0920	0.1204	0.1411	0.1502	0.1570	0.1618	0.1599
0.35	0.0849	0.1169	0.1395	0.1487	0.1557	0.1613	0.1602
0.40	0.0770	0.1120	0.1380	0.1470	0.1543	0.1607	0.1605
0.45	0.0687	0.1053	0.1365	0.1454	0.1530	0.1600	0.1608
0.50	0.0602	0.0982	0.1350	0.1440	0.1517	0.1593	0.1607
0.55	0.0512	0.0907	0.1322	0.1423	0.1502	0.1585	0.1605
0.60	0.0417	0.0827	0.1272	0.1408	0.1490	0.1577	0.1601
0.65	0.0320	0.0743	0.1202	0.1391	0.1475	0.1566	0.1596
0.70	0.0223	0.0656	0.1125	0.1377	0.1462	0.1554	0.1588
0.75	0.0124	0.0565	0.1044	0.1357	0.1445	0.1542	0.1577
0.80	0.0016	0.0472	0.0960	0.1326	0.1427	0.1527	0.1565
0.85		0.0377	0.0870	0.1275	0.1405	0.1510	0.1550
0.90		0.0282	0.0788	0.1207	0.1375	0.1492	0.1538
0.95		0.0182	0.0688	0.1135	0.1345	0.1470	0.1522
1.00		0.0080	0.0595	0.1060	0.1317	0.1445	0.1507
1.05		-0.0018	0.0500	0.0980	0.1290	0.1418	0.1490
1.10			0.0400	0.0896	0.1255	0.1392	0.1475
1.15			0.0297	0.0810	0.1202	0.1372	0.1460
1.20			0.0189	0.0719	0.1140	0.1355	0.1443
1.25			0.0080	0.0624	0.1067	0.1340	0.1428
1.30			-0.0028	0.0527	0.0993	0.1324	0.1412
1.35				0.0430	0.0913	0.1300	0.1398
1.40				0.0327	0.0830	0.1267	0.1385
1.45				0.0225	0.0750	0.1215	0.1371
1.50				0.0124	0.0658	0.1157	0.1360
1.55				0.0020	0.0570	0.1090	0.1348
1.60					0.0478	0.1020	0.1339
1.65					0.0385	0.0940	0.1324
1.70					0.0288	0.0858	0.1303

J\β0.75	15	20	25	30	35	40	45
1.75					0.0195	0.0770	0.1270
1.80					0.0100	0.0685	0.1220
1.85					0.0007	0.0595	0.1160
1.90						0.0500	0.1095
1.95						0.0410	0.1030
2.00						0.0320	0.0950
2.05						0.0230	0.0876
2.10						0.0147	0.0800
2.15						0.0058	0.0714
2.20						-0.0025	0.0632
2.25							0.0550
2.30							0.0470
2.35							0.0387
2.40							0.0305
2.45							0.0228
2.50							0.0150
2.55							0.0070
2.60							-0.0005

Thrust coefficient [1]

2.2. Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.00	0.0529	0.1140	0.1563	0.2074	0.2695	0.3324	0.3868
0.05	0.0529	0.1078	0.1522	0.2051	0.2662	0.3291	0.3842
0.10	0.0529	0.1009	0.1510	0.2030	0.2631	0.3260	0.3817
0.15	0.0527	0.0948	0.1494	0.2007	0.2600	0.3228	0.3792
0.20	0.0522	0.0897	0.1474	0.1982	0.2567	0.3197	0.3767
0.25	0.0516	0.0851	0.1451	0.1959	0.2535	0.3164	0.3742
0.30	0.0505	0.0812	0.1425	0.1933	0.2501	0.3132	0.3717
0.35	0.0487	0.0782	0.1397	0.1908	0.2467	0.3100	0.3693
0.40	0.0463	0.0760	0.1363	0.1881	0.2432	0.3067	0.3667
0.45	0.0432	0.0741	0.1326	0.1853	0.2396	0.3033	0.3640
0.50	0.0398	0.0719	0.1285	0.1824	0.2360	0.3000	0.3614
0.55	0.0358	0.0691	0.1238	0.1794	0.2323	0.2963	0.3586
0.60	0.0313	0.0657	0.1187	0.1761	0.2285	0.2927	0.3557
0.65	0.0260	0.0615	0.1133	0.1721	0.2245	0.2890	0.3527
0.70	0.0201	0.0567	0.1082	0.1686	0.2205	0.2853	0.3499
0.75	0.0131	0.0510	0.1028	0.1643	0.2165	0.2813	0.3466
0.80	0.0047	0.0446	0.0970	0.1594	0.2121	0.2770	0.3434
0.85		0.0376	0.0910	0.1537	0.2078	0.2730	0.3400
0.90		0.0300	0.0847	0.1466	0.2028	0.2683	0.3362
0.95		0.0215	0.0775	0.1400	0.1982	0.2634	0.3324
1.00		0.0125	0.0695	0.1324	0.1940	0.2580	0.3277
1.05		0.0020	0.0600	0.1250	0.1895	0.2530	0.3232
1.10			0.0502	0.1171	0.1841	0.2490	0.3183
1.15			0.0392	0.1085	0.1777	0.2455	0.3135
1.20			0.0275	0.0990	0.1700	0.2428	0.3088
1.25			0.0145	0.0880	0.1624	0.2400	0.3052
1.30			0.0015	0.0769	0.1533	0.2360	0.3015
1.35				0.0650	0.1440	0.2310	0.2990
1.40				0.0514	0.1340	0.2255	0.2964
1.45				0.0380	0.1240	0.2185	0.2948
1.50				0.0231	0.1117	0.2103	0.2925
1.55				0.0080	0.0990	0.2010	0.2904
1.60					0.0850	0.1910	0.2878
1.65					0.0712	0.1790	0.2845
1.70					0.0558	0.1670	0.2805

J\β0.75	15	20	25	30	35	40	45
1.75					0.0400	0.1540	0.2760
1.80					0.0237	0.1400	0.2690
1.85					0.0078	0.1240	0.2590
1.90						0.1080	0.2480
1.95						0.0915	0.2353
2.00						0.0745	0.2220
2.05						0.0575	0.2080
2.10						0.0400	0.1920
2.15						0.0220	0.1750
2.20						0.0038	0.1580
2.25							0.1400
2.30							0.1230
2.35							0.1050
2.40							0.0870
2.45							0.0688
2.50							0.0505
2.55							0.0320
2.60							0.0140

Power coefficient [1]

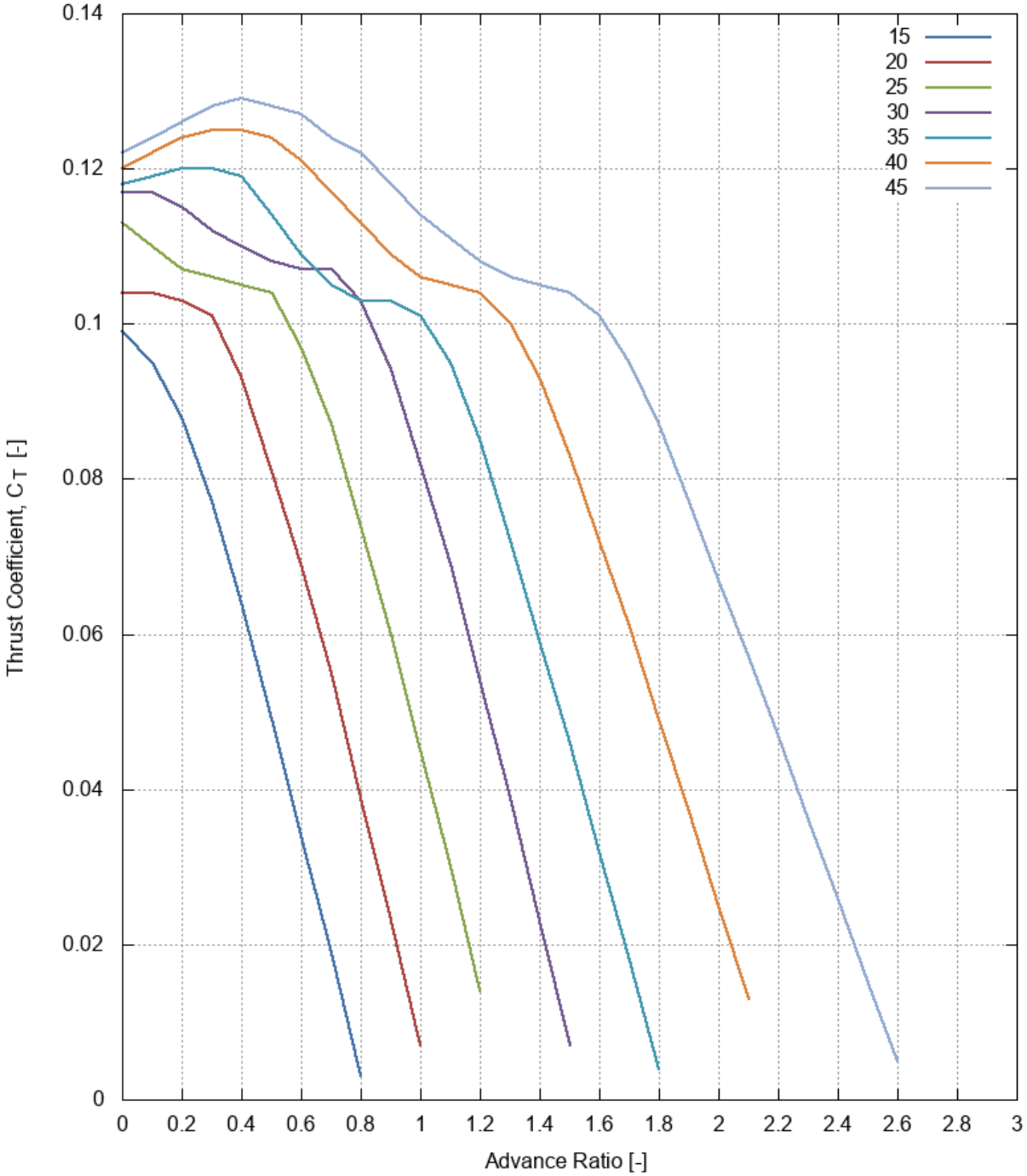
2.3. Efficiency, η

J\β0.75	15	20	25	30	35	40	45
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.05	0.113	0.060	0.049	0.039	0.031	0.025	0.021
0.10	0.217	0.128	0.098	0.077	0.062	0.050	0.042
0.15	0.314	0.201	0.146	0.116	0.093	0.076	0.063
0.20	0.402	0.280	0.196	0.155	0.124	0.102	0.085
0.25	0.479	0.362	0.246	0.194	0.156	0.128	0.106
0.30	0.546	0.445	0.298	0.233	0.188	0.155	0.129
0.35	0.610	0.523	0.350	0.273	0.221	0.182	0.152
0.40	0.665	0.590	0.405	0.312	0.254	0.210	0.175
0.45	0.715	0.640	0.463	0.353	0.288	0.238	0.199
0.50	0.756	0.684	0.525	0.395	0.322	0.266	0.222
0.55	0.786	0.722	0.588	0.436	0.356	0.294	0.246
0.60	0.800	0.755	0.644	0.480	0.391	0.323	0.270
0.65	0.800	0.785	0.690	0.525	0.427	0.352	0.294
0.70	0.777	0.810	0.728	0.572	0.464	0.381	0.318
0.75	0.710	0.830	0.762	0.620	0.500	0.412	0.341
0.80	0.272	0.846	0.791	0.665	0.538	0.441	0.365
0.85		0.852	0.812	0.705	0.575	0.470	0.388
0.90		0.846	0.837	0.740	0.610	0.500	0.411
0.95		0.805	0.845	0.770	0.645	0.530	0.435
1.00		0.640	0.856	0.800	0.678	0.560	0.460
1.05			0.874	0.823	0.715	0.589	0.484
1.10			0.876	0.841	0.750	0.615	0.510
1.15			0.871	0.859	0.779	0.643	0.536
1.20			0.825	0.870	0.804	0.670	0.560
1.25			0.745	0.885	0.820	0.698	0.585
1.30				0.891	0.842	0.730	0.610
1.35				0.893	0.855	0.760	0.631
1.40				0.890	0.867	0.796	0.655
1.45				0.858	0.876	0.805	0.675
1.50				0.806	0.884	0.825	0.698
1.55				0.387	0.893	0.841	0.720
1.60					0.900	0.855	0.745
1.65					0.892	0.866	0.767
1.70					0.876	0.873	0.790

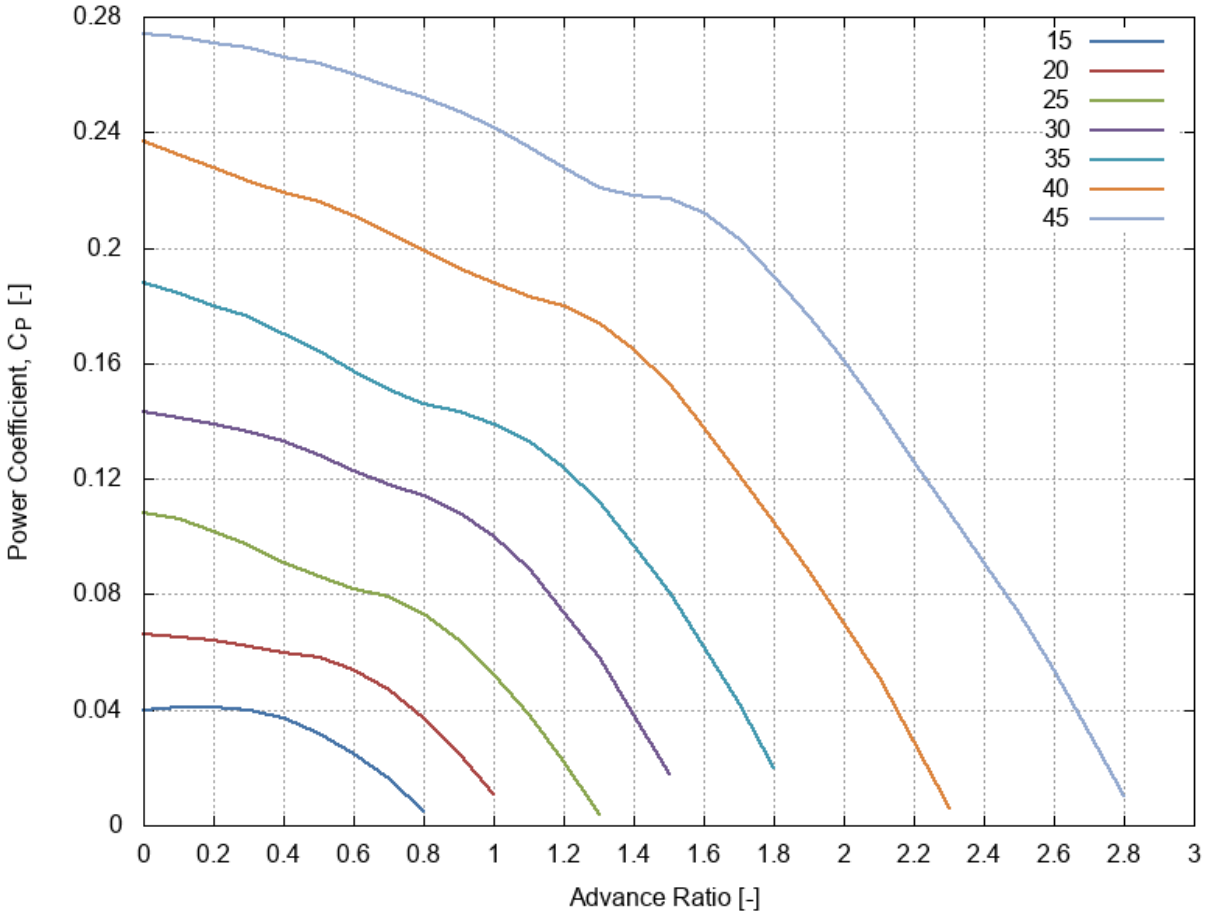
$J\backslash\beta_{0.75}$	15	20	25	30	35	40	45
1.75					0.853	0.875	0.805
1.80					0.760	0.881	0.816
1.85					0.166	0.888	0.829
1.90						0.880	0.839
1.95						0.874	0.855
2.00						0.860	0.855
2.05						0.810	0.863
2.10						0.771	0.874
2.15						0.566	0.877
2.20							0.880
2.25							0.883
2.30							0.878
2.35							0.867
2.40							0.842
2.45							0.812
2.50							0.742
2.55							0.558

Efficiency [1]

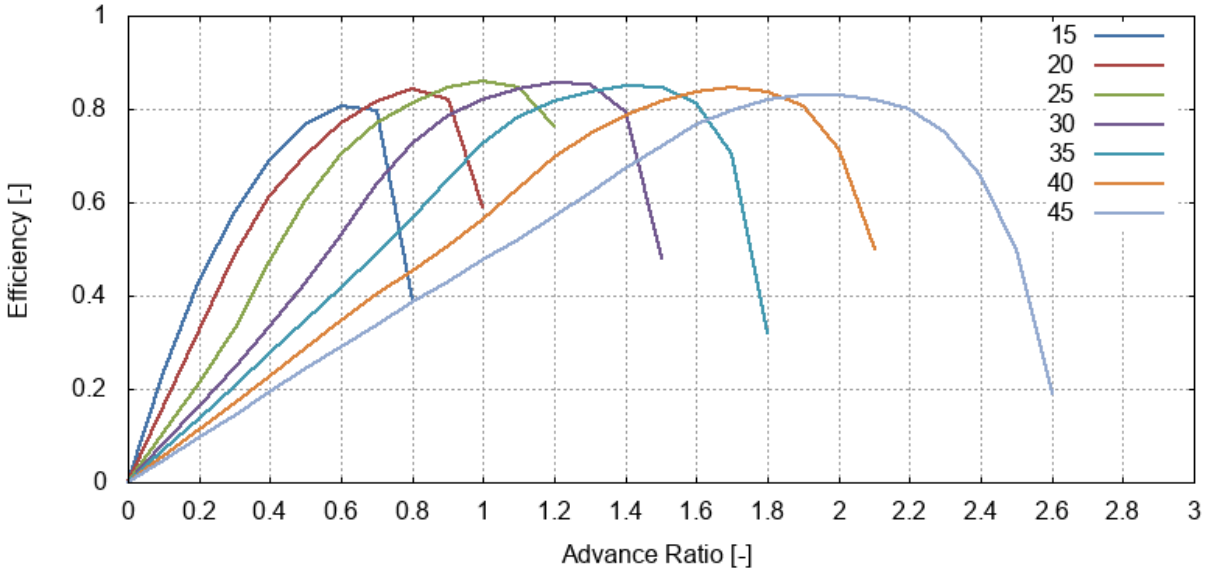
3. US Navy Bureau of Aeronautics propeller 5868-9, 2 blades



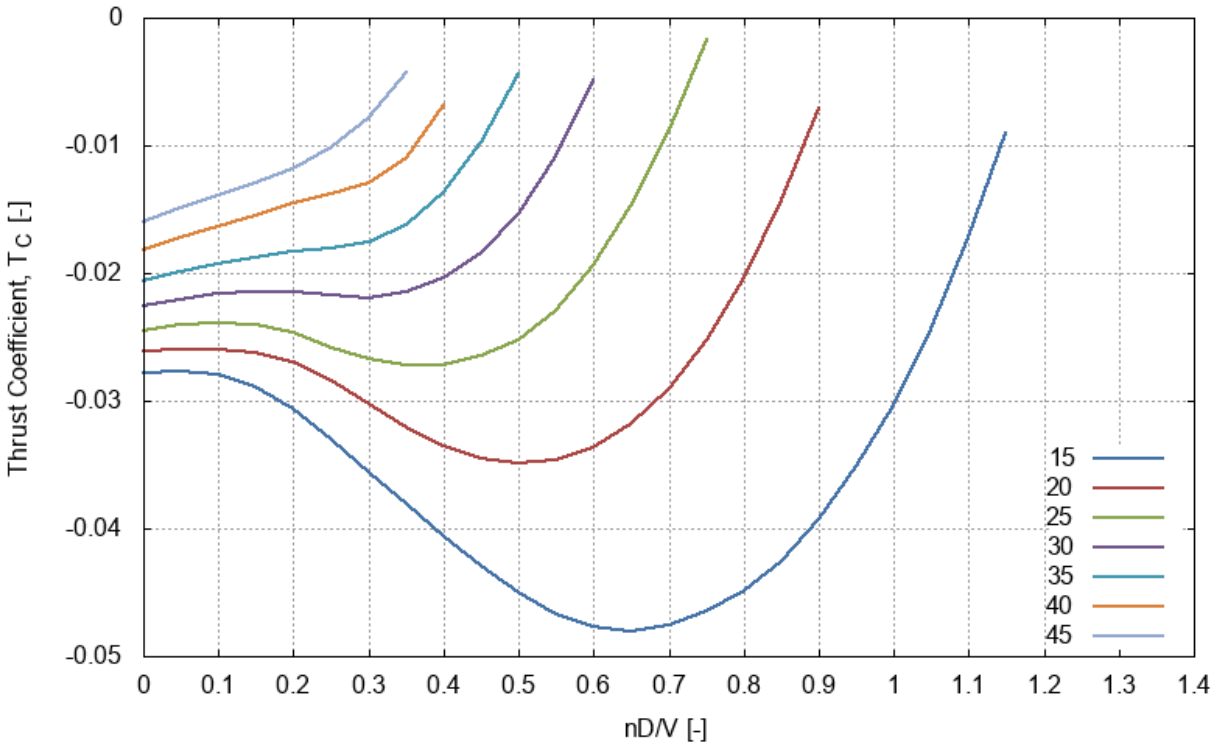
Thrust coefficient [2]



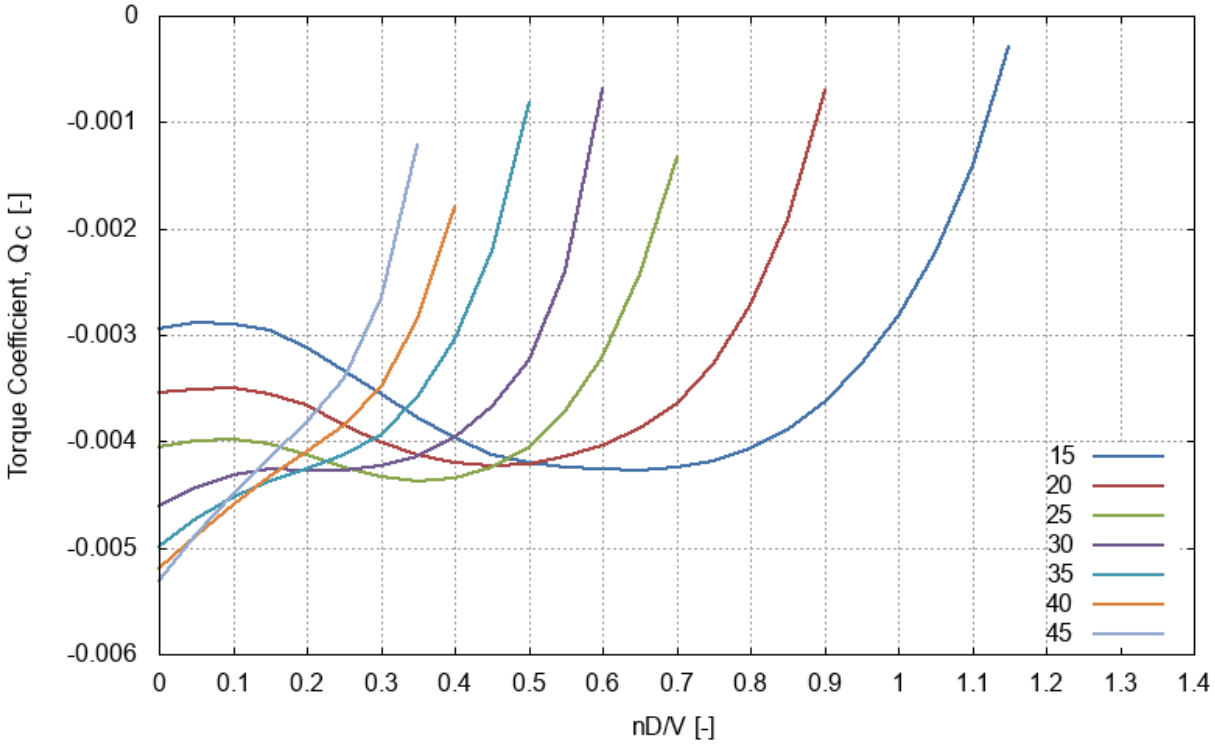
Power coefficient [2]



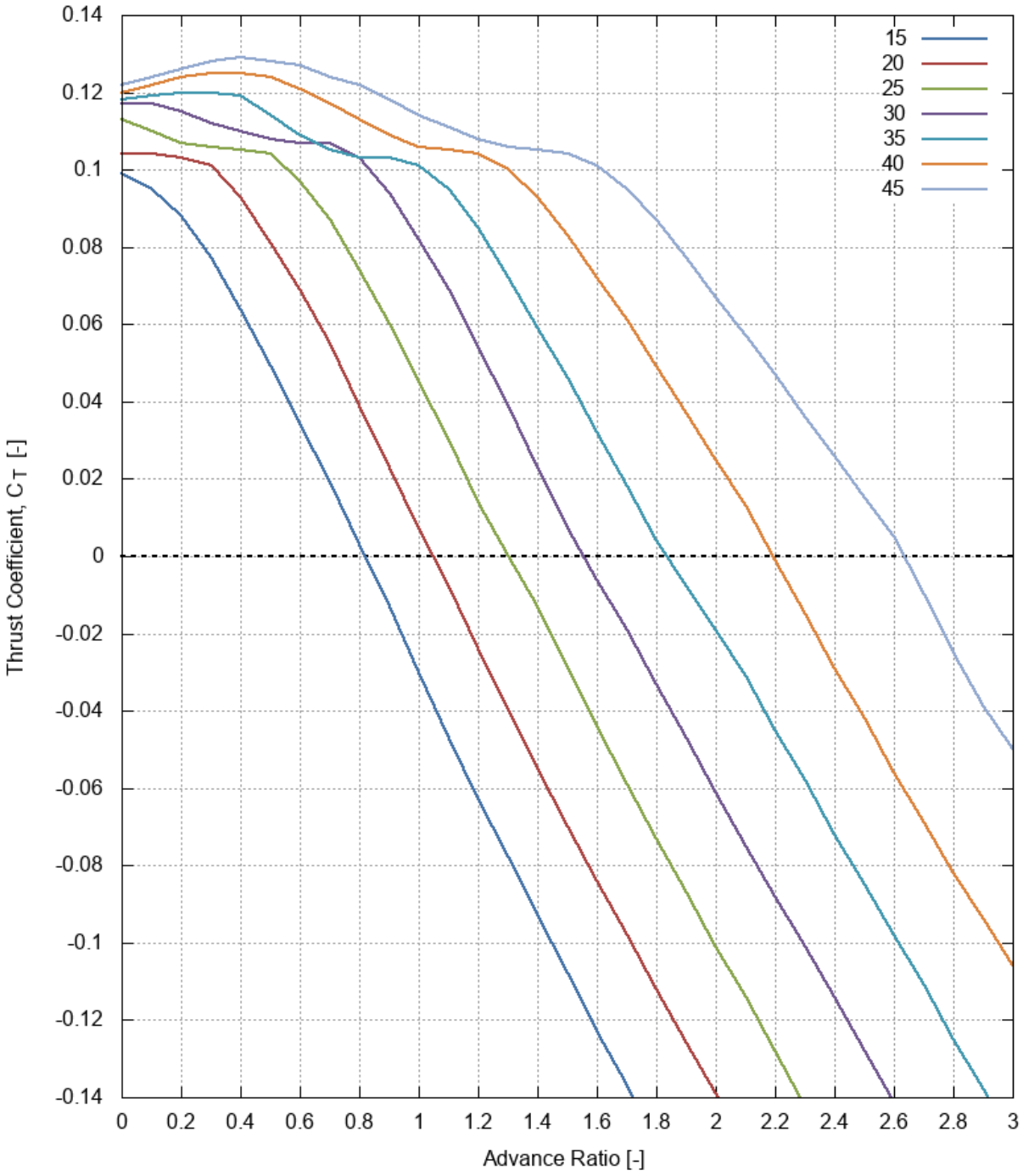
Efficiency [2]



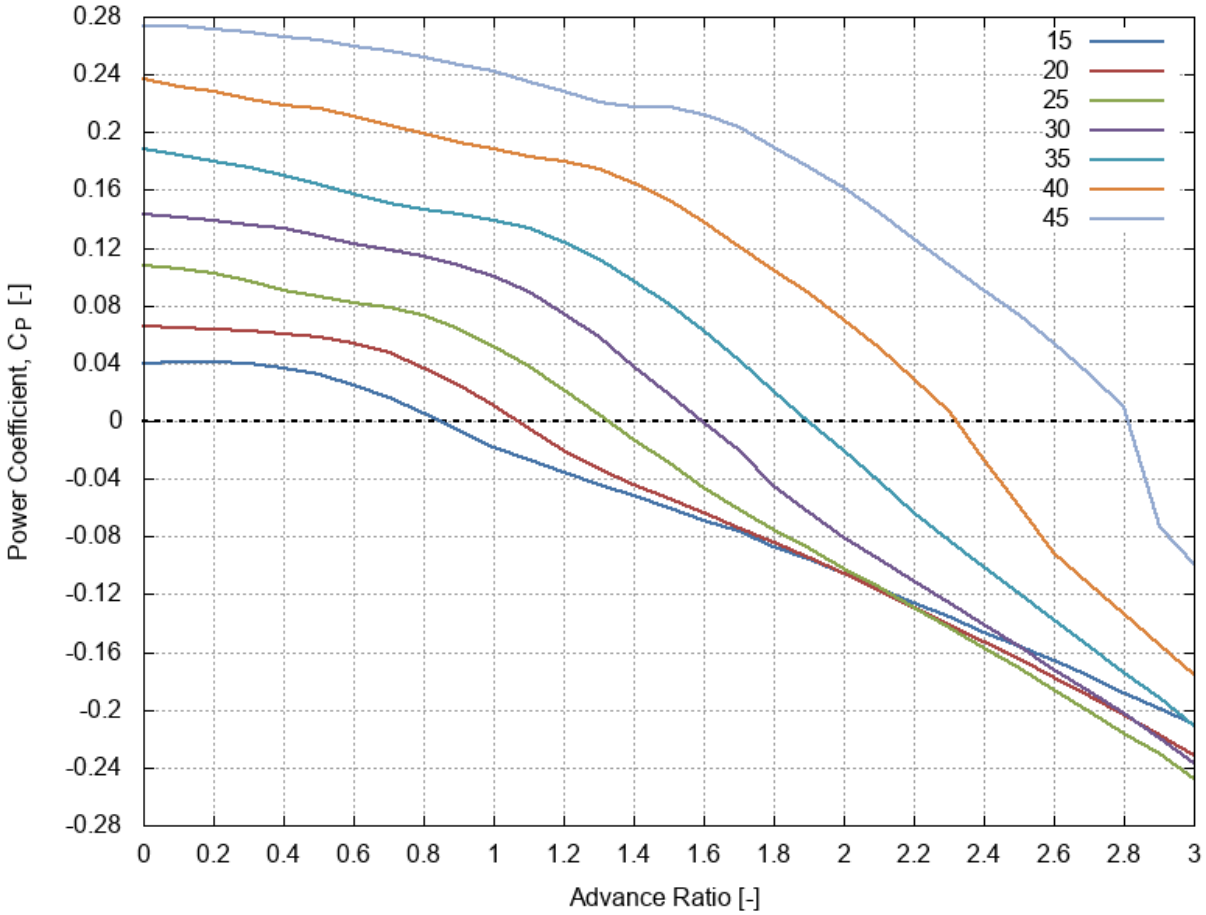
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [2], [3]



Combined power coefficient [2], [3]

3.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35	40	45
0.0	0.099	0.104	0.113	0.117	0.118	0.120	0.122
0.1	0.095	0.104	0.110	0.117	0.119	0.122	0.124
0.2	0.088	0.103	0.107	0.115	0.120	0.124	0.126
0.3	0.077	0.101	0.106	0.112	0.120	0.125	0.128
0.4	0.064	0.093	0.105	0.110	0.119	0.125	0.129
0.5	0.049	0.081	0.104	0.108	0.114	0.124	0.128
0.6	0.034	0.069	0.097	0.107	0.109	0.121	0.127
0.7	0.019	0.055	0.087	0.107	0.105	0.117	0.124
0.8	0.003	0.039	0.074	0.103	0.103	0.113	0.122
0.9		0.023	0.060	0.094	0.103	0.109	0.118
1.0		0.007	0.045	0.082	0.101	0.106	0.114
1.1			0.030	0.069	0.095	0.105	0.111
1.2			0.014	0.054	0.085	0.104	0.108
1.3				0.039	0.072	0.100	0.106
1.4				0.023	0.059	0.093	0.105
1.5				0.007	0.046	0.083	0.104
1.6					0.032	0.072	0.101
1.7					0.018	0.061	0.095
1.8					0.004	0.049	0.087
1.9						0.037	0.077
2.0						0.025	0.067
2.1						0.013	0.057
2.2							0.047
2.3							0.036
2.4							0.026
2.5							0.015
2.6							0.005

Thrust coefficient [2]

3.2. Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.040	0.066	0.108	0.143	0.188	0.237	0.274
0.1	0.041	0.065	0.106	0.141	0.184	0.232	0.273
0.2	0.041	0.064	0.102	0.139	0.180	0.228	0.271
0.3	0.040	0.062	0.097	0.136	0.176	0.223	0.269
0.4	0.037	0.060	0.091	0.133	0.170	0.219	0.266
0.5	0.032	0.058	0.086	0.128	0.164	0.216	0.264
0.6	0.025	0.054	0.082	0.123	0.157	0.211	0.260
0.7	0.016	0.047	0.079	0.118	0.151	0.205	0.256
0.8	0.005	0.037	0.073	0.114	0.146	0.199	0.252
0.9		0.025	0.064	0.108	0.143	0.193	0.247
1.0		0.011	0.052	0.100	0.139	0.188	0.242
1.1			0.038	0.089	0.133	0.183	0.235
1.2			0.022	0.074	0.124	0.180	0.228
1.3			0.004	0.058	0.112	0.174	0.221
1.4				0.038	0.097	0.165	0.218
1.5				0.018	0.081	0.153	0.217
1.6					0.062	0.138	0.212
1.7					0.042	0.121	0.203
1.8					0.020	0.105	0.190
1.9						0.088	0.176
2.0						0.070	0.161
2.1						0.051	0.144
2.2						0.029	0.126
2.3						0.006	0.108
2.4							0.091
2.5							0.073
2.6							0.054
2.7							0.032
2.8							0.010

Power coefficient [2]

3.3. Efficiency, η

J\β0.75	15	20	25	30	35	40	45
0.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.238	0.164	0.107	0.082	0.069	0.056	0.048
0.2	0.432	0.327	0.214	0.163	0.138	0.113	0.096
0.3	0.581	0.490	0.331	0.248	0.206	0.169	0.144
0.4	0.689	0.614	0.473	0.333	0.277	0.226	0.192
0.5	0.766	0.701	0.603	0.425	0.348	0.287	0.243
0.6	0.807	0.770	0.702	0.529	0.418	0.347	0.291
0.7	0.798	0.818	0.769	0.639	0.489	0.402	0.338
0.8	0.389	0.844	0.814	0.726	0.566	0.454	0.385
0.9		0.819	0.846	0.785	0.651	0.506	0.430
1.0		0.590	0.861	0.819	0.728	0.564	0.475
1.1			0.847	0.844	0.784	0.631	0.520
1.2			0.764	0.858	0.816	0.696	0.569
1.3				0.854	0.837	0.746	0.621
1.4				0.794	0.849	0.786	0.672
1.5				0.479	0.847	0.817	0.720
1.6					0.813	0.838	0.765
1.7					0.702	0.847	0.798
1.8					0.320	0.836	0.819
1.9						0.805	0.831
2.0						0.714	0.829
2.1						0.500	0.819
2.2							0.799
2.3							0.749
2.4							0.657
2.5							0.495
2.6							0.189

Efficiency [2]

3.4. Negative Thrust Coefficient, T_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.028	-0.026	-0.024	-0.023	-0.021	-0.018	-0.016
0.05	-0.028	-0.026	-0.024	-0.022	-0.020	-0.017	-0.015
0.10	-0.028	-0.026	-0.024	-0.022	-0.019	-0.016	-0.014
0.15	-0.029	-0.026	-0.024	-0.021	-0.019	-0.015	-0.013
0.20	-0.031	-0.027	-0.025	-0.021	-0.018	-0.015	-0.012
0.25	-0.033	-0.028	-0.026	-0.022	-0.018	-0.014	-0.010
0.30	-0.036	-0.030	-0.027	-0.022	-0.018	-0.013	-0.008
0.35	-0.038	-0.032	-0.027	-0.022	-0.016	-0.011	-0.004
0.40	-0.041	-0.034	-0.027	-0.020	-0.014	-0.007	
0.45	-0.043	-0.034	-0.027	-0.018	-0.010		
0.50	-0.045	-0.035	-0.025	-0.015	-0.004		
0.55	-0.047	-0.035	-0.023	-0.011			
0.60	-0.048	-0.034	-0.019	-0.005			
0.65	-0.048	-0.032	-0.015				
0.70	-0.048	-0.029	-0.009				
0.75	-0.046	-0.025	-0.002				
0.80	-0.045	-0.020					
0.85	-0.043	-0.014					
0.90	-0.039	-0.007					
0.95	-0.035						
1.00	-0.030						
1.05	-0.024						
1.10	-0.017						
1.15	-0.009						

Negative thrust coefficient [3]

3.5. Negative Torque Coefficient, Q_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.0029	-0.0035	-0.0041	-0.0046	-0.0050	-0.0052	-0.0053
0.05	-0.0029	-0.0035	-0.0040	-0.0044	-0.0047	-0.0049	-0.0049
0.10	-0.0029	-0.0035	-0.0040	-0.0043	-0.0045	-0.0046	-0.0045
0.15	-0.0030	-0.0036	-0.0040	-0.0043	-0.0044	-0.0043	-0.0042
0.20	-0.0031	-0.0037	-0.0041	-0.0043	-0.0043	-0.0041	-0.0038
0.25	-0.0033	-0.0038	-0.0042	-0.0043	-0.0041	-0.0039	-0.0034
0.30	-0.0036	-0.0040	-0.0043	-0.0042	-0.0039	-0.0035	-0.0026
0.35	-0.0038	-0.0041	-0.0044	-0.0041	-0.0036	-0.0029	-0.0012
0.40	-0.0040	-0.0042	-0.0044	-0.0040	-0.0030	-0.0018	
0.45	-0.0041	-0.0042	-0.0042	-0.0037	-0.0022		
0.50	-0.0042	-0.0042	-0.0041	-0.0032	-0.0008		
0.55	-0.0042	-0.0041	-0.0037	-0.0024			
0.60	-0.0043	-0.0040	-0.0032	-0.0007			
0.65	-0.0043	-0.0039	-0.0024				
0.70	-0.0042	-0.0036	-0.0013				
0.75	-0.0042	-0.0033					
0.80	-0.0041	-0.0027					
0.85	-0.0039	-0.0019					
0.90	-0.0036	-0.0007					
0.95	-0.0033						
1.00	-0.0028						
1.05	-0.0022						
1.10	-0.0014						
1.15	-0.0003						

Negative torque coefficient [3]

3.6. Combined Thrust Coefficient, C_T

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.099	0.104	0.113	0.117	0.118	0.120	0.122
0.1	0.095	0.104	0.110	0.117	0.119	0.122	0.124
0.2	0.088	0.103	0.107	0.115	0.120	0.124	0.126
0.3	0.077	0.101	0.106	0.112	0.120	0.125	0.128
0.4	0.064	0.093	0.105	0.110	0.119	0.125	0.129
0.5	0.049	0.081	0.104	0.108	0.114	0.124	0.128
0.6	0.034	0.069	0.097	0.107	0.109	0.121	0.127
0.7	0.019	0.055	0.087	0.107	0.105	0.117	0.124
0.8	0.003	0.039	0.074	0.103	0.103	0.113	0.122
0.9	-0.013	0.023	0.060	0.094	0.103	0.109	0.118
1.0	-0.030	0.007	0.045	0.082	0.101	0.106	0.114
1.1	-0.047	-0.008	0.030	0.069	0.095	0.105	0.111
1.2	-0.063	-0.024	0.014	0.054	0.085	0.104	0.108
1.3	-0.078	-0.040	0.000	0.039	0.072	0.100	0.106
1.4	-0.093	-0.055	-0.013	0.023	0.059	0.093	0.105
1.5	-0.108	-0.070	-0.029	0.007	0.046	0.083	0.104
1.6	-0.123	-0.084	-0.044	-0.006	0.032	0.072	0.101
1.7	-0.137	-0.098	-0.059	-0.019	0.018	0.061	0.095
1.8	-0.152	-0.112	-0.073	-0.033	0.004	0.049	0.087
1.9	-0.166	-0.126	-0.087	-0.047	-0.008	0.037	0.077
2.0	-0.180	-0.139	-0.101	-0.061	-0.019	0.025	0.067
2.1	-0.194	-0.153	-0.114	-0.075	-0.031	0.013	0.057
2.2	-0.209	-0.167	-0.128	-0.088	-0.045	-0.001	0.047
2.3	-0.224	-0.181	-0.142	-0.101	-0.058	-0.015	0.036
2.4	-0.239	-0.196	-0.156	-0.114	-0.072	-0.029	0.026
2.5	-0.253	-0.210	-0.170	-0.128	-0.085	-0.042	0.015
2.6	-0.270	-0.224	-0.184	-0.141	-0.098	-0.056	0.005
2.7	-0.286	-0.239	-0.199	-0.154	-0.111	-0.069	-0.010
2.8	-0.302	-0.253	-0.214	-0.168	-0.125	-0.082	-0.025
2.9	-0.319	-0.268	-0.229	-0.182	-0.138	-0.094	-0.039
3.0	-0.336	-0.284	-0.245	-0.196	-0.151	-0.106	-0.050
3.1	-0.354	-0.300	-0.260	-0.211	-0.164	-0.117	-0.061
3.2	-0.372	-0.316	-0.276	-0.225	-0.178	-0.129	-0.072
3.3	-0.390	-0.331	-0.292	-0.240	-0.191	-0.140	-0.083
3.4	-0.409	-0.348	-0.309	-0.255	-0.205	-0.151	-0.095

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
3.5	-0.429	-0.366	-0.326	-0.270	-0.219	-0.163	-0.106
3.6	-0.449	-0.384	-0.344	-0.286	-0.233	-0.174	-0.117
3.7	-0.469	-0.401	-0.361	-0.301	-0.247	-0.186	-0.129
3.8	-0.489	-0.419	-0.378	-0.317	-0.261	-0.197	-0.140
3.9	-0.509	-0.436	-0.396	-0.332	-0.275	-0.208	-0.151
4.0	-0.529	-0.454	-0.413	-0.347	-0.289	-0.220	-0.163
4.1	-0.552	-0.476	-0.433	-0.366	-0.306	-0.234	-0.176
4.2	-0.576	-0.498	-0.454	-0.385	-0.322	-0.249	-0.189
4.3	-0.600	-0.520	-0.474	-0.404	-0.339	-0.263	-0.202
4.4	-0.624	-0.542	-0.494	-0.423	-0.356	-0.278	-0.215
4.5	-0.647	-0.564	-0.514	-0.442	-0.373	-0.292	-0.229
4.6	-0.671	-0.586	-0.535	-0.461	-0.390	-0.306	-0.242
4.7	-0.695	-0.608	-0.555	-0.479	-0.407	-0.321	-0.255
4.8	-0.718	-0.629	-0.575	-0.498	-0.424	-0.335	-0.268
4.9	-0.742	-0.651	-0.595	-0.517	-0.441	-0.350	-0.281
5.0	-0.766	-0.673	-0.616	-0.536	-0.458	-0.364	-0.294

Combined thrust coefficient [2], [3]

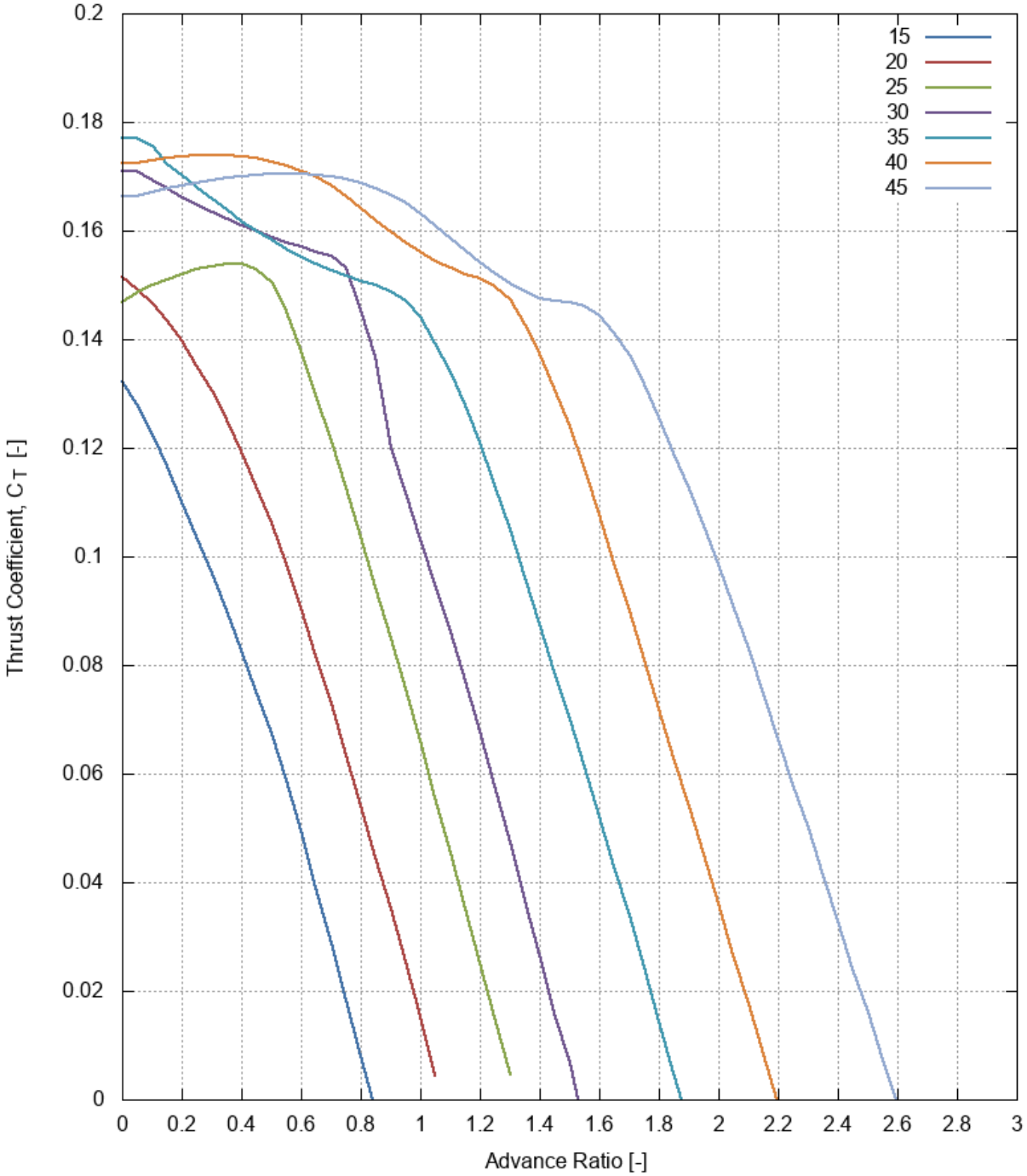
3.7. Combined Power Coefficient, C_P

J\β0.75	15	20	25	30	35	40	45
0.0	0.040	0.066	0.108	0.143	0.188	0.237	0.274
0.1	0.041	0.065	0.106	0.141	0.184	0.232	0.273
0.2	0.041	0.064	0.102	0.139	0.180	0.228	0.271
0.3	0.040	0.062	0.097	0.136	0.176	0.223	0.269
0.4	0.037	0.060	0.091	0.133	0.170	0.219	0.266
0.5	0.032	0.058	0.086	0.128	0.164	0.216	0.264
0.6	0.025	0.054	0.082	0.123	0.157	0.211	0.260
0.7	0.016	0.047	0.079	0.118	0.151	0.205	0.256
0.8	0.005	0.037	0.073	0.114	0.146	0.199	0.252
0.9	-0.006	0.025	0.064	0.108	0.143	0.193	0.247
1.0	-0.018	0.011	0.052	0.100	0.139	0.188	0.242
1.1	-0.027	-0.005	0.038	0.089	0.133	0.183	0.235
1.2	-0.036	-0.020	0.022	0.074	0.124	0.180	0.228
1.3	-0.044	-0.033	0.004	0.058	0.112	0.174	0.221
1.4	-0.052	-0.044	-0.013	0.038	0.097	0.165	0.218
1.5	-0.060	-0.054	-0.029	0.018	0.081	0.153	0.217
1.6	-0.069	-0.064	-0.046	-0.001	0.062	0.138	0.212
1.7	-0.077	-0.074	-0.061	-0.020	0.042	0.121	0.203
1.8	-0.087	-0.084	-0.075	-0.045	0.020	0.105	0.190
1.9	-0.096	-0.095	-0.088	-0.064	-0.001	0.088	0.176
2.0	-0.106	-0.106	-0.102	-0.081	-0.021	0.070	0.161
2.1	-0.116	-0.117	-0.115	-0.096	-0.042	0.051	0.144
2.2	-0.126	-0.129	-0.129	-0.111	-0.064	0.029	0.126
2.3	-0.136	-0.141	-0.143	-0.126	-0.083	0.006	0.108
2.4	-0.146	-0.153	-0.157	-0.141	-0.101	-0.027	0.091
2.5	-0.156	-0.165	-0.171	-0.156	-0.120	-0.059	0.073
2.6	-0.166	-0.178	-0.186	-0.172	-0.138	-0.092	0.054
2.7	-0.177	-0.191	-0.201	-0.187	-0.156	-0.113	0.032
2.8	-0.188	-0.204	-0.216	-0.203	-0.174	-0.134	0.010
2.9	-0.199	-0.218	-0.231	-0.220	-0.192	-0.155	-0.073
3.0	-0.210	-0.232	-0.248	-0.237	-0.211	-0.176	-0.099
3.1	-0.222	-0.247	-0.264	-0.255	-0.231	-0.196	-0.125
3.2	-0.233	-0.261	-0.280	-0.272	-0.250	-0.216	-0.151
3.3	-0.245	-0.275	-0.297	-0.289	-0.269	-0.236	-0.176
3.4	-0.257	-0.291	-0.315	-0.309	-0.289	-0.257	-0.201

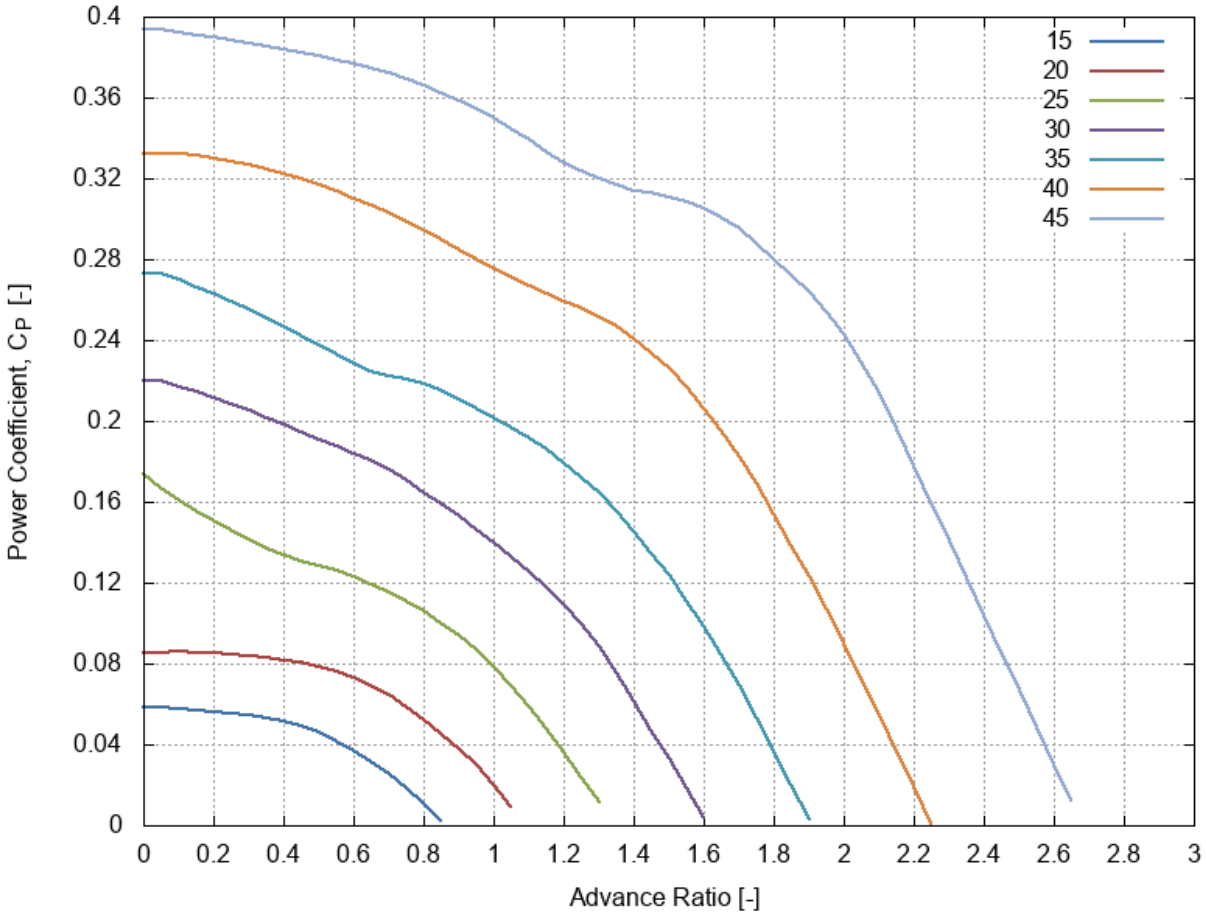
J\β0.75	15	20	25	30	35	40	45
3.5	-0.270	-0.307	-0.333	-0.329	-0.310	-0.279	-0.224
3.6	-0.283	-0.323	-0.352	-0.349	-0.331	-0.301	-0.248
3.7	-0.296	-0.339	-0.370	-0.369	-0.352	-0.322	-0.271
3.8	-0.309	-0.355	-0.389	-0.389	-0.373	-0.344	-0.295
3.9	-0.322	-0.371	-0.408	-0.410	-0.394	-0.366	-0.319
4.0	-0.335	-0.387	-0.426	-0.430	-0.415	-0.387	-0.342
4.1	-0.350	-0.405	-0.448	-0.454	-0.441	-0.413	-0.368
4.2	-0.366	-0.424	-0.470	-0.478	-0.466	-0.439	-0.394
4.3	-0.381	-0.443	-0.493	-0.502	-0.491	-0.464	-0.420
4.4	-0.397	-0.462	-0.515	-0.527	-0.517	-0.490	-0.446
4.5	-0.413	-0.481	-0.537	-0.551	-0.542	-0.516	-0.472
4.6	-0.428	-0.500	-0.559	-0.575	-0.568	-0.541	-0.497
4.7	-0.444	-0.518	-0.581	-0.599	-0.593	-0.567	-0.523
4.8	-0.459	-0.537	-0.603	-0.623	-0.618	-0.593	-0.549
4.9	-0.475	-0.556	-0.625	-0.647	-0.644	-0.618	-0.575
5.0	-0.490	-0.575	-0.647	-0.672	-0.669	-0.644	-0.601

Combined power coefficient [2], [3]

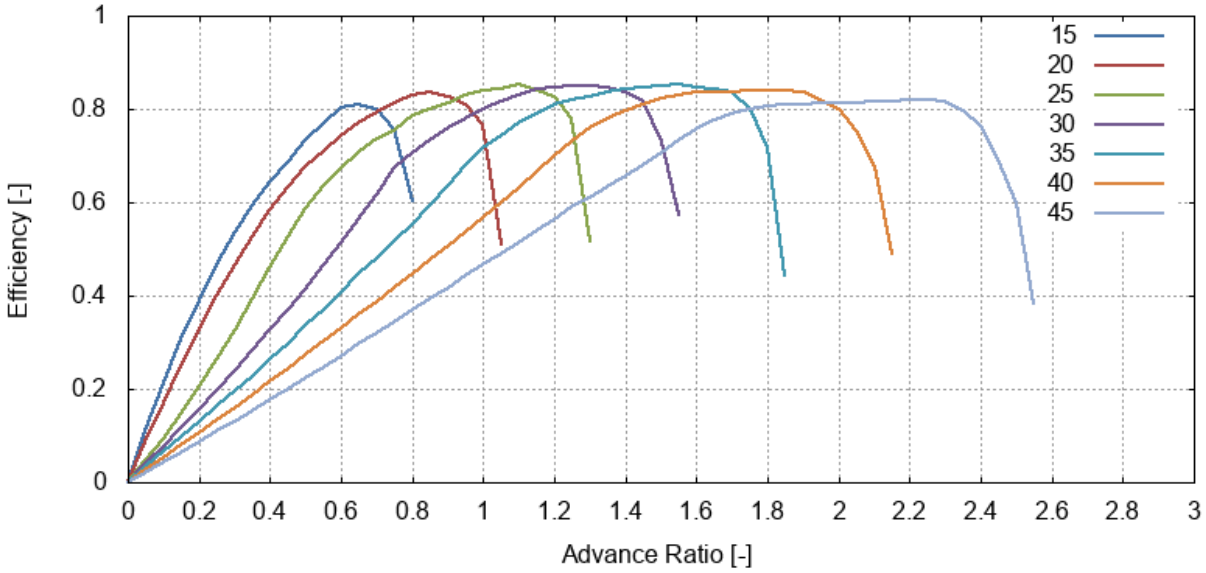
4. US Navy Bureau of Aeronautics propeller 5868-9, 3 blades



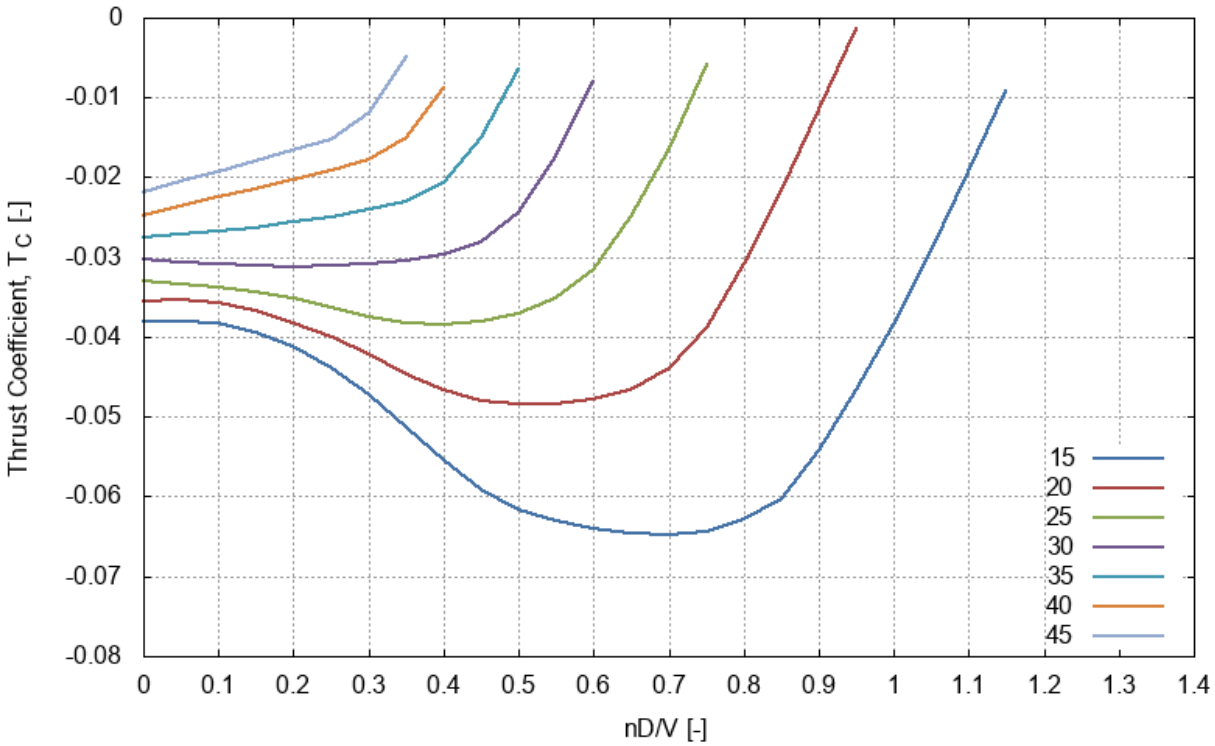
Thrust coefficient [1]



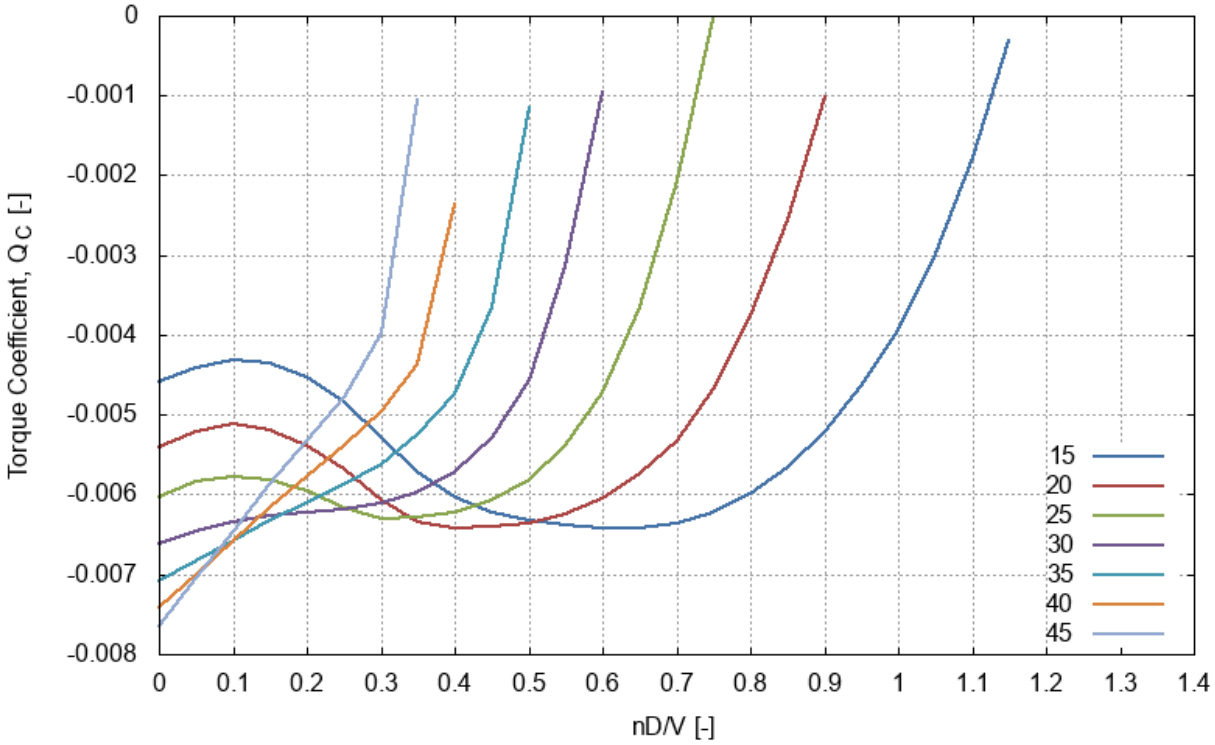
Power coefficient [1]



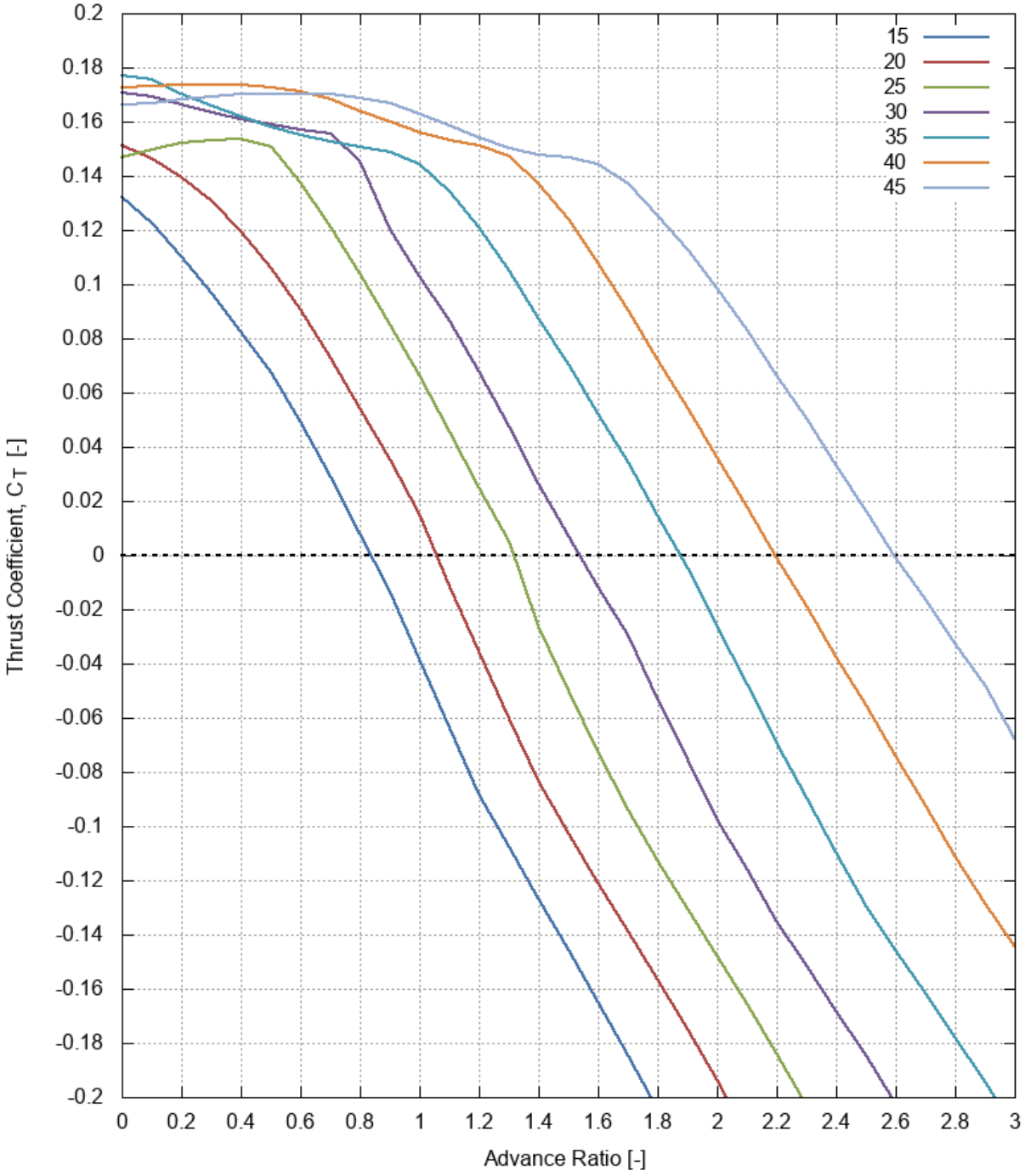
Efficiency [1]



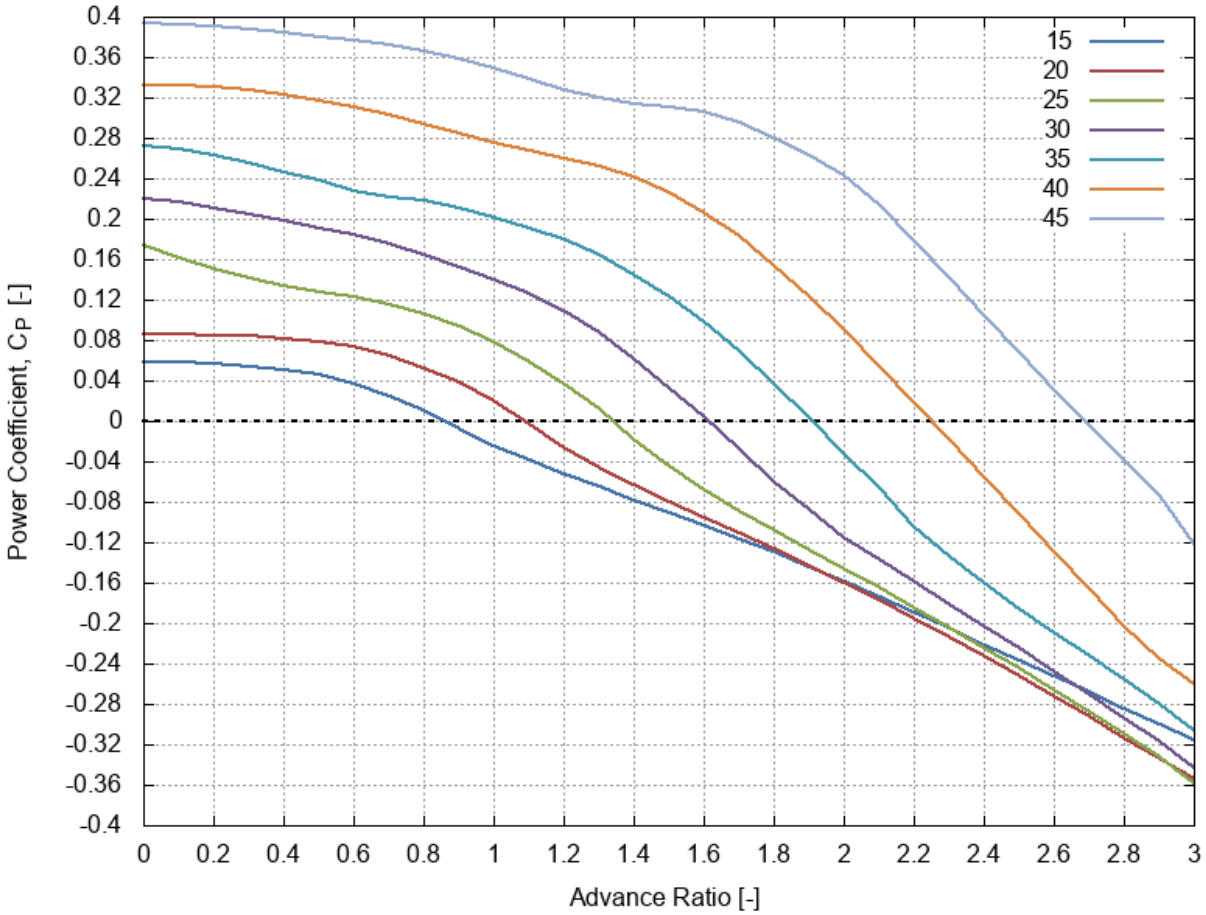
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [1], [3]



Combined power coefficient [1], [3]

4.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35	40	45
0.00	0.1322	0.1514	0.1469	0.1709	0.1770	0.1725	0.1663
0.05	0.1280	0.1492	0.1486	0.1709	0.1770	0.1725	0.1663
0.10	0.1224	0.1465	0.1499	0.1692	0.1757	0.1730	0.1670
0.15	0.1165	0.1433	0.1510	0.1678	0.1723	0.1733	0.1677
0.20	0.1101	0.1397	0.1520	0.1662	0.1702	0.1737	0.1682
0.25	0.1036	0.1352	0.1529	0.1648	0.1680	0.1738	0.1687
0.30	0.0968	0.1306	0.1534	0.1635	0.1659	0.1739	0.1692
0.35	0.0899	0.1252	0.1538	0.1622	0.1638	0.1738	0.1697
0.40	0.0826	0.1193	0.1538	0.1610	0.1618	0.1737	0.1700
0.45	0.0752	0.1129	0.1529	0.1599	0.1600	0.1733	0.1702
0.50	0.0674	0.1060	0.1505	0.1588	0.1582	0.1728	0.1704
0.55	0.0587	0.0985	0.1452	0.1578	0.1566	0.1720	0.1705
0.60	0.0495	0.0905	0.1378	0.1570	0.1550	0.1710	0.1704
0.65	0.0391	0.0818	0.1297	0.1562	0.1538	0.1699	0.1702
0.70	0.0288	0.0729	0.1212	0.1554	0.1527	0.1684	0.1700
0.75	0.0183	0.0635	0.1126	0.1532	0.1517	0.1663	0.1694
0.80	0.0080	0.0542	0.1037	0.1454	0.1508	0.1641	0.1687
0.85	-0.0020	0.0447	0.0943	0.1369	0.1501	0.1619	0.1678
0.90		0.0350	0.0849	0.1201	0.1488	0.1598	0.1666
0.95		0.0254	0.0757	0.1117	0.1471	0.1578	0.1650
1.00		0.0153	0.0662	0.1031	0.1442	0.1560	0.1631
1.05		0.0043	0.0557	0.0948	0.1393	0.1545	0.1609
1.10			0.0454	0.0862	0.1340	0.1531	0.1585
1.15			0.0350	0.0770	0.1279	0.1520	0.1563
1.20			0.0250	0.0679	0.1210	0.1511	0.1542
1.25			0.0150	0.0577	0.1131	0.1497	0.1522
1.30			0.0047	0.0472	0.1048	0.1472	0.1503
1.35				0.0365	0.0962	0.1427	0.1488
1.40				0.0265	0.0875	0.1372	0.1476
1.45				0.0159	0.0788	0.1310	0.1470
1.50				0.0068	0.0700	0.1240	0.1468
1.55				-0.0047	0.0611	0.1160	0.1460
1.60					0.0521	0.1078	0.1445
1.65					0.0430	0.0988	0.1413
1.70					0.0340	0.0900	0.1370

J\β0.75	15	20	25	30	35	40	45
1.75					0.0243	0.0810	0.1318
1.80					0.0145	0.0720	0.1255
1.85					0.0048	0.0630	0.1191
1.90					-0.0051	0.0540	0.1125
1.95						0.0450	0.1056
2.00						0.0360	0.0986
2.05						0.0265	0.0910
2.10						0.0175	0.0830
2.15						0.0083	0.0746
2.20						-0.0008	0.0663
2.25						-0.0100	0.0580
2.30							0.0500
2.35							0.0412
2.40							0.0330
2.45							0.0242
2.50							0.0160
2.55							0.0073
2.60							-0.0010
2.65							-0.0095

Thrust coefficient [1]

4.2. Power Coefficient, C_P

J\β0.75	15	20	25	30	35	40	45
0.00	0.0584	0.0856	0.1742	0.2201	0.2728	0.3324	0.3937
0.05	0.0582	0.0857	0.1668	0.2201	0.2728	0.3324	0.3937
0.10	0.0578	0.0858	0.1610	0.2173	0.2699	0.3320	0.3925
0.15	0.0572	0.0857	0.1556	0.2144	0.2665	0.3313	0.3911
0.20	0.0564	0.0853	0.1505	0.2114	0.2630	0.3302	0.3900
0.25	0.0555	0.0848	0.1460	0.2083	0.2592	0.3288	0.3886
0.30	0.0543	0.0840	0.1414	0.2050	0.2552	0.3270	0.3871
0.35	0.0530	0.0831	0.1373	0.2017	0.2510	0.3249	0.3857
0.40	0.0514	0.0819	0.1338	0.1982	0.2467	0.3226	0.3840
0.45	0.0492	0.0804	0.1307	0.1947	0.2422	0.3199	0.3824
0.50	0.0461	0.0786	0.1282	0.1910	0.2377	0.3170	0.3806
0.55	0.0419	0.0764	0.1258	0.1874	0.2330	0.3138	0.3788
0.60	0.0370	0.0732	0.1230	0.1840	0.2283	0.3102	0.3767
0.65	0.0314	0.0691	0.1194	0.1804	0.2245	0.3066	0.3743
0.70	0.0252	0.0643	0.1155	0.1761	0.2220	0.3027	0.3720
0.75	0.0182	0.0586	0.1110	0.1708	0.2206	0.2988	0.3690
0.80	0.0106	0.0523	0.1062	0.1649	0.2186	0.2945	0.3660
0.85	0.0025	0.0455	0.1003	0.1589	0.2154	0.2898	0.3625
0.90		0.0380	0.0940	0.1528	0.2110	0.2847	0.3587
0.95		0.0298	0.0868	0.1461	0.2062	0.2799	0.3544
1.00		0.0200	0.0788	0.1397	0.2015	0.2755	0.3498
1.05		0.0090	0.0693	0.1329	0.1968	0.2712	0.3446
1.10			0.0586	0.1256	0.1915	0.2672	0.3390
1.15			0.0480	0.1175	0.1858	0.2632	0.3333
1.20			0.0364	0.1090	0.1795	0.2595	0.3280
1.25			0.0240	0.1000	0.1723	0.2560	0.3236
1.30			0.0118	0.0881	0.1644	0.2519	0.3199
1.35				0.0752	0.1550	0.2470	0.3168
1.40				0.0612	0.1453	0.2409	0.3142
1.45				0.0470	0.1345	0.2340	0.3127
1.50				0.0327	0.1236	0.2262	0.3110
1.55				0.0184	0.1110	0.2170	0.3088
1.60				0.0040	0.0984	0.2065	0.3054

J\β0.75	15	20	25	30	35	40	45
1.65					0.0843	0.1950	0.3010
1.70					0.0693	0.1825	0.2950
1.75					0.0531	0.1690	0.2880
1.80					0.0365	0.1540	0.2800
1.85					0.0200	0.1385	0.2720
1.90					0.0031	0.1230	0.2636
1.95						0.1070	0.2535
2.00						0.0900	0.2427
2.05						0.0720	0.2293
2.10						0.0545	0.2135
2.15						0.0365	0.1961
2.20						0.0190	0.1780
2.25						0.0010	0.1595
2.30							0.1410
2.35							0.1220
2.40							0.1040
2.45							0.0855
2.50							0.0670
2.55							0.0485
2.60							0.0300
2.65							0.0120

Power coefficient [1]

4.3. Efficiency, η

J\β0.75	15	20	25	30	35	40	45
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.05	0.110	0.087	0.045	0.039	0.033	0.026	0.021
0.10	0.212	0.170	0.093	0.078	0.065	0.052	0.043
0.15	0.306	0.251	0.146	0.117	0.097	0.079	0.064
0.20	0.391	0.328	0.208	0.157	0.130	0.105	0.086
0.25	0.467	0.399	0.262	0.198	0.162	0.132	0.109
0.30	0.535	0.467	0.325	0.240	0.195	0.160	0.131
0.35	0.593	0.528	0.392	0.282	0.228	0.187	0.154
0.40	0.643	0.583	0.460	0.325	0.262	0.215	0.177
0.45	0.688	0.632	0.527	0.370	0.297	0.244	0.200
0.50	0.732	0.675	0.587	0.414	0.335	0.273	0.224
0.55	0.770	0.710	0.635	0.465	0.370	0.302	0.247
0.60	0.802	0.743	0.673	0.512	0.407	0.330	0.271
0.65	0.810	0.770	0.705	0.563	0.445	0.360	0.295
0.70	0.800	0.793	0.735	0.617	0.480	0.388	0.320
0.75	0.755	0.812	0.752	0.673	0.516	0.417	0.344
0.80	0.604	0.829	0.788	0.705	0.552	0.445	0.369
0.85		0.835	0.800	0.733	0.593	0.477	0.393
0.90		0.828	0.813	0.760	0.635	0.505	0.418
0.95		0.810	0.829	0.781	0.680	0.536	0.442
1.00		0.765	0.840	0.800	0.715	0.568	0.467
1.05		0.510	0.844	0.815	0.743	0.599	0.490
1.10			0.852	0.830	0.770	0.631	0.514
1.15			0.839	0.844	0.791	0.665	0.540
1.20			0.825	0.848	0.810	0.699	0.564
1.25			0.781	0.849	0.821	0.730	0.589
1.30			0.518	0.851	0.828	0.761	0.611
1.35				0.845	0.837	0.780	0.633
1.40				0.835	0.843	0.797	0.657
1.45				0.818	0.848	0.811	0.681
1.50				0.730	0.850	0.822	0.708
1.55				0.572	0.853	0.829	0.732
1.60					0.848	0.835	0.756
1.65					0.842	0.836	0.775
1.70					0.835	0.838	0.790

J\β0.75	15	20	25	30	35	40	45
1.75					0.800	0.839	0.800
1.80					0.715	0.840	0.806
1.85					0.444	0.841	0.810
1.90						0.835	0.811
1.95						0.820	0.812
2.00						0.800	0.813
2.05						0.754	0.814
2.10						0.675	0.816
2.15						0.489	0.818
2.20							0.819
2.25							0.820
2.30							0.816
2.35							0.795
2.40							0.762
2.45							0.694
2.50							0.597
2.55							0.383

Efficiency [1]

4.4. Negative Thrust Coefficient, T_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.038	-0.036	-0.033	-0.030	-0.027	-0.025	-0.022
0.05	-0.038	-0.035	-0.033	-0.031	-0.027	-0.024	-0.020
0.10	-0.038	-0.036	-0.034	-0.031	-0.027	-0.022	-0.019
0.15	-0.039	-0.037	-0.034	-0.031	-0.026	-0.021	-0.018
0.20	-0.041	-0.038	-0.035	-0.031	-0.026	-0.020	-0.017
0.25	-0.044	-0.040	-0.036	-0.031	-0.025	-0.019	-0.015
0.30	-0.047	-0.042	-0.037	-0.031	-0.024	-0.018	-0.012
0.35	-0.051	-0.045	-0.038	-0.030	-0.023	-0.015	-0.005
0.40	-0.055	-0.047	-0.038	-0.030	-0.021	-0.009	
0.45	-0.059	-0.048	-0.038	-0.028	-0.015		
0.50	-0.062	-0.048	-0.037	-0.024	-0.006		
0.55	-0.063	-0.048	-0.035	-0.017			
0.60	-0.064	-0.048	-0.032	-0.008			
0.65	-0.065	-0.047	-0.025				
0.70	-0.065	-0.044	-0.016				
0.75	-0.064	-0.039	-0.006				
0.80	-0.063	-0.031					
0.85	-0.060	-0.022					
0.90	-0.054	-0.012					
0.95	-0.047	-0.001					
1.00	-0.038						
1.05	-0.029						
1.10	-0.019						
1.15	-0.009						

Negative thrust coefficient [3]

4.5. Negative Torque Coefficient, Q_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.0046	-0.0054	-0.0060	-0.0066	-0.0071	-0.0074	-0.0077
0.05	-0.0044	-0.0052	-0.0058	-0.0065	-0.0068	-0.0070	-0.0070
0.10	-0.0043	-0.0051	-0.0058	-0.0063	-0.0066	-0.0066	-0.0065
0.15	-0.0043	-0.0052	-0.0058	-0.0063	-0.0063	-0.0062	-0.0059
0.20	-0.0045	-0.0054	-0.0059	-0.0062	-0.0061	-0.0058	-0.0053
0.25	-0.0048	-0.0057	-0.0062	-0.0062	-0.0059	-0.0054	-0.0048
0.30	-0.0053	-0.0061	-0.0063	-0.0061	-0.0056	-0.0050	-0.0040
0.35	-0.0057	-0.0063	-0.0063	-0.0060	-0.0052	-0.0044	-0.0010
0.40	-0.0060	-0.0064	-0.0062	-0.0057	-0.0047	-0.0024	
0.45	-0.0062	-0.0064	-0.0061	-0.0053	-0.0036		
0.50	-0.0063	-0.0064	-0.0058	-0.0046	-0.0011		
0.55	-0.0064	-0.0062	-0.0054	-0.0031			
0.60	-0.0064	-0.0061	-0.0047	-0.0010			
0.65	-0.0064	-0.0057	-0.0037				
0.70	-0.0064	-0.0053	-0.0021				
0.75	-0.0062	-0.0047	0.0000				
0.80	-0.0060	-0.0038					
0.85	-0.0057	-0.0025					
0.90	-0.0052	-0.0010					
0.95	-0.0046						
1.00	-0.0039						
1.05	-0.0030						
1.10	-0.0018						
1.15	-0.0003						

Negative torque coefficient [3]

4.6. Combined Thrust Coefficient, C_T

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.1322	0.1514	0.1469	0.1709	0.1770	0.1725	0.1663
0.1	0.1224	0.1465	0.1499	0.1692	0.1757	0.1730	0.1670
0.2	0.1101	0.1397	0.1520	0.1662	0.1702	0.1737	0.1682
0.3	0.0968	0.1306	0.1534	0.1635	0.1659	0.1739	0.1692
0.4	0.0826	0.1193	0.1538	0.1610	0.1618	0.1737	0.1700
0.5	0.0674	0.1060	0.1505	0.1588	0.1582	0.1728	0.1704
0.6	0.0495	0.0905	0.1378	0.1570	0.1550	0.1710	0.1704
0.7	0.0288	0.0729	0.1212	0.1554	0.1527	0.1684	0.1700
0.8	0.0080	0.0542	0.1037	0.1454	0.1508	0.1641	0.1687
0.9	-0.0139	0.0350	0.0849	0.1201	0.1488	0.1598	0.1666
1.0	-0.0384	0.0153	0.0662	0.1031	0.1442	0.1560	0.1631
1.1	-0.0641	-0.0119	0.0454	0.0862	0.1340	0.1531	0.1585
1.2	-0.0881	-0.0358	0.0250	0.0679	0.1210	0.1511	0.1542
1.3	-0.1079	-0.0607	0.0047	0.0472	0.1048	0.1472	0.1503
1.4	-0.1270	-0.0834	-0.0264	0.0265	0.0875	0.1372	0.1476
1.5	-0.1458	-0.1031	-0.0501	0.0068	0.0700	0.1240	0.1468
1.6	-0.1650	-0.1212	-0.0729	-0.0116	0.0521	0.1078	0.1445
1.7	-0.1847	-0.1389	-0.0940	-0.0300	0.0340	0.0900	0.1370
1.8	-0.2049	-0.1567	-0.1128	-0.0533	0.0145	0.0720	0.1255
1.9	-0.2256	-0.1752	-0.1305	-0.0755	-0.0051	0.0540	0.1125
2.0	-0.2463	-0.1937	-0.1480	-0.0974	-0.0263	0.0360	0.0986
2.1	-0.2669	-0.2132	-0.1660	-0.1162	-0.0476	0.0175	0.0830
2.2	-0.2876	-0.2327	-0.1840	-0.1349	-0.0693	-0.0008	0.0663
2.3	-0.3074	-0.2523	-0.2025	-0.1519	-0.0897	-0.0191	0.0500
2.4	-0.3269	-0.2721	-0.2211	-0.1684	-0.1098	-0.0374	0.0330
2.5	-0.3465	-0.2918	-0.2397	-0.1850	-0.1299	-0.0557	0.0160
2.6	-0.3666	-0.3122	-0.2598	-0.2027	-0.1460	-0.0740	-0.0010
2.7	-0.3867	-0.3325	-0.2800	-0.2203	-0.1621	-0.0926	-0.0168
2.8	-0.4068	-0.3529	-0.3001	-0.2380	-0.1782	-0.1113	-0.0326
2.9	-0.4280	-0.3740	-0.3210	-0.2566	-0.1946	-0.1287	-0.0485
3.0	-0.4505	-0.3959	-0.3428	-0.2764	-0.2115	-0.1444	-0.0678
3.1	-0.4730	-0.4178	-0.3646	-0.2962	-0.2283	-0.1602	-0.0871
3.2	-0.4956	-0.4397	-0.3865	-0.3160	-0.2451	-0.1760	-0.1065
3.3	-0.5181	-0.4616	-0.4083	-0.3358	-0.2619	-0.1918	-0.1258
3.4	-0.5433	-0.4861	-0.4322	-0.3578	-0.2808	-0.2080	-0.1435

$J\backslash\beta_{0.75}$	15	20	25	30	35	40	45
3.5	-0.5698	-0.5120	-0.4572	-0.3808	-0.3007	-0.2244	-0.1604
3.6	-0.5963	-0.5378	-0.4821	-0.4039	-0.3205	-0.2409	-0.1772
3.7	-0.6227	-0.5637	-0.5070	-0.4270	-0.3404	-0.2573	-0.1941
3.8	-0.6492	-0.5895	-0.5319	-0.4501	-0.3602	-0.2738	-0.2110
3.9	-0.6757	-0.6154	-0.5569	-0.4732	-0.3801	-0.2902	-0.2278
4.0	-0.7022	-0.6412	-0.5818	-0.4963	-0.4000	-0.3066	-0.2447
4.1	-0.7348	-0.6726	-0.6115	-0.5245	-0.4241	-0.3267	-0.2617
4.2	-0.7673	-0.7039	-0.6413	-0.5528	-0.4482	-0.3467	-0.2788
4.3	-0.7998	-0.7352	-0.6710	-0.5811	-0.4724	-0.3668	-0.2958
4.4	-0.8324	-0.7665	-0.7007	-0.6093	-0.4965	-0.3869	-0.3129
4.5	-0.8649	-0.7979	-0.7305	-0.6376	-0.5206	-0.4069	-0.3299
4.6	-0.8975	-0.8292	-0.7602	-0.6659	-0.5447	-0.4270	-0.3470
4.7	-0.9300	-0.8605	-0.7900	-0.6941	-0.5689	-0.4470	-0.3640
4.8	-0.9625	-0.8919	-0.8197	-0.7224	-0.5930	-0.4671	-0.3811
4.9	-0.9951	-0.9232	-0.8495	-0.7506	-0.6171	-0.4871	-0.3981
5.0	-1.0276	-0.9545	-0.8792	-0.7789	-0.6413	-0.5072	-0.4152

Combined thrust coefficient [1], [3]

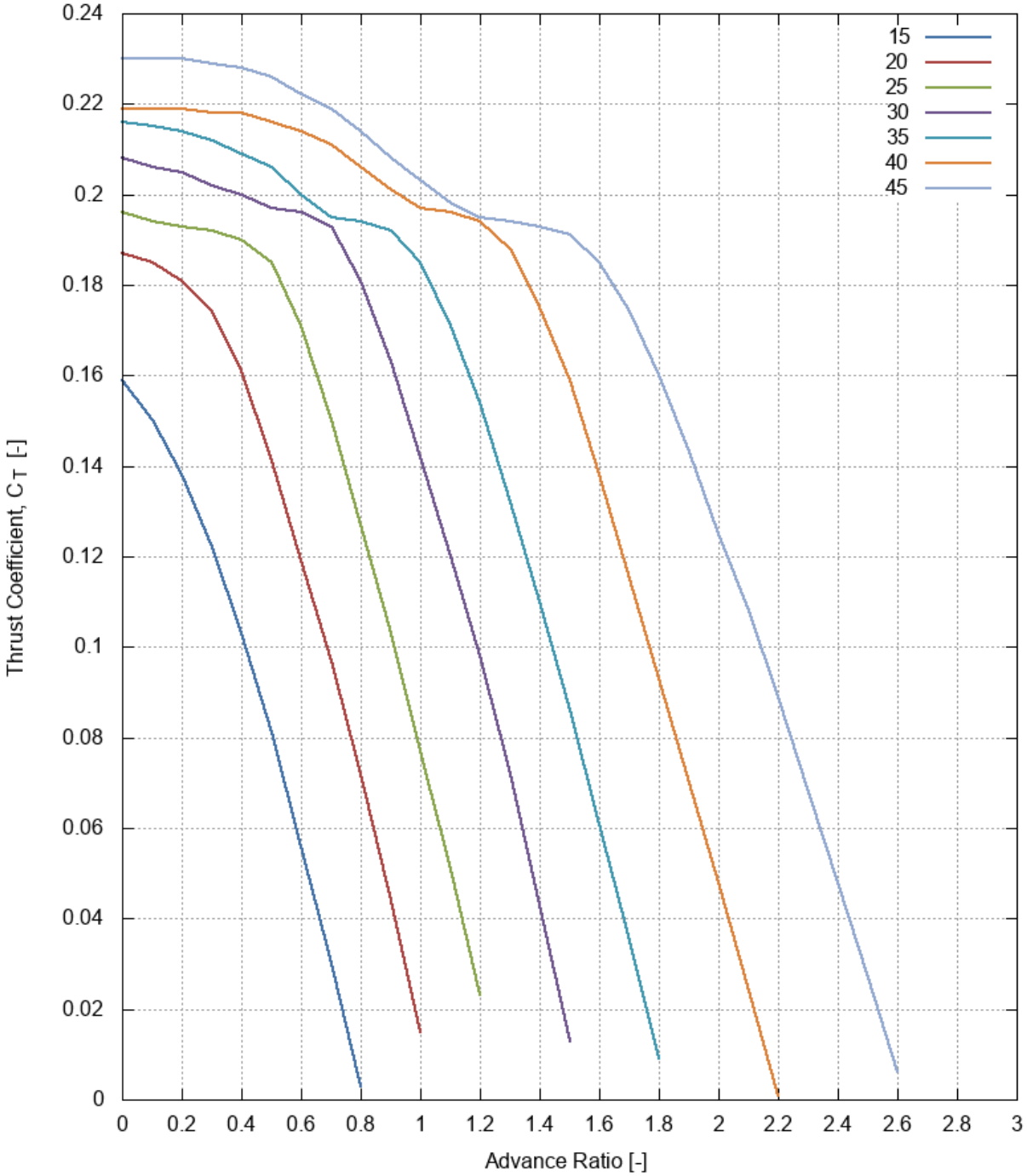
4.7. Combined Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.0584	0.0856	0.1742	0.2201	0.2728	0.3324	0.3937
0.1	0.0578	0.0858	0.1610	0.2173	0.2699	0.3320	0.3925
0.2	0.0564	0.0853	0.1505	0.2114	0.2630	0.3302	0.3900
0.3	0.0543	0.0840	0.1414	0.2050	0.2552	0.3270	0.3871
0.4	0.0514	0.0819	0.1338	0.1982	0.2467	0.3226	0.3840
0.5	0.0461	0.0786	0.1282	0.1910	0.2377	0.3170	0.3806
0.6	0.0370	0.0732	0.1230	0.1840	0.2283	0.3102	0.3767
0.7	0.0252	0.0643	0.1155	0.1761	0.2220	0.3027	0.3720
0.8	0.0106	0.0523	0.1062	0.1649	0.2186	0.2945	0.3660
0.9	-0.0075	0.0380	0.0940	0.1528	0.2110	0.2847	0.3587
1.0	-0.0248	0.0200	0.0788	0.1397	0.2015	0.2755	0.3498
1.1	-0.0389	-0.0035	0.0586	0.1256	0.1915	0.2672	0.3390
1.2	-0.0523	-0.0269	0.0364	0.1090	0.1795	0.2595	0.3280
1.3	-0.0652	-0.0462	0.0118	0.0881	0.1644	0.2519	0.3199
1.4	-0.0779	-0.0635	-0.0188	0.0612	0.1453	0.2409	0.3142
1.5	-0.0905	-0.0794	-0.0446	0.0327	0.1236	0.2262	0.3110
1.6	-0.1033	-0.0951	-0.0678	0.0040	0.0984	0.2065	0.3054
1.7	-0.1164	-0.1109	-0.0889	-0.0275	0.0693	0.1825	0.2950
1.8	-0.1300	-0.1268	-0.1083	-0.0593	0.0365	0.1540	0.2800
1.9	-0.1443	-0.1432	-0.1272	-0.0874	0.0031	0.1230	0.2636
2.0	-0.1588	-0.1598	-0.1461	-0.1147	-0.0318	0.0900	0.2427
2.1	-0.1742	-0.1774	-0.1651	-0.1369	-0.0667	0.0545	0.2135
2.2	-0.1896	-0.1949	-0.1842	-0.1591	-0.1047	0.0190	0.1780
2.3	-0.2052	-0.2137	-0.2041	-0.1810	-0.1336	-0.0180	0.1410
2.4	-0.2208	-0.2328	-0.2243	-0.2029	-0.1599	-0.0551	0.1040
2.5	-0.2364	-0.2520	-0.2445	-0.2247	-0.1862	-0.0921	0.0670
2.6	-0.2522	-0.2724	-0.2663	-0.2475	-0.2094	-0.1292	0.0300
2.7	-0.2680	-0.2929	-0.2882	-0.2704	-0.2327	-0.1659	-0.0046
2.8	-0.2839	-0.3134	-0.3100	-0.2932	-0.2560	-0.2027	-0.0392
2.9	-0.2998	-0.3339	-0.3330	-0.3171	-0.2803	-0.2348	-0.0738
3.0	-0.3159	-0.3545	-0.3577	-0.3424	-0.3061	-0.2606	-0.1210
3.1	-0.3321	-0.3751	-0.3823	-0.3677	-0.3319	-0.2864	-0.1682
3.2	-0.3482	-0.3957	-0.4070	-0.3931	-0.3577	-0.3121	-0.2154
3.3	-0.3643	-0.4163	-0.4316	-0.4184	-0.3835	-0.3379	-0.2626
3.4	-0.3814	-0.4379	-0.4578	-0.4464	-0.4119	-0.3660	-0.2985

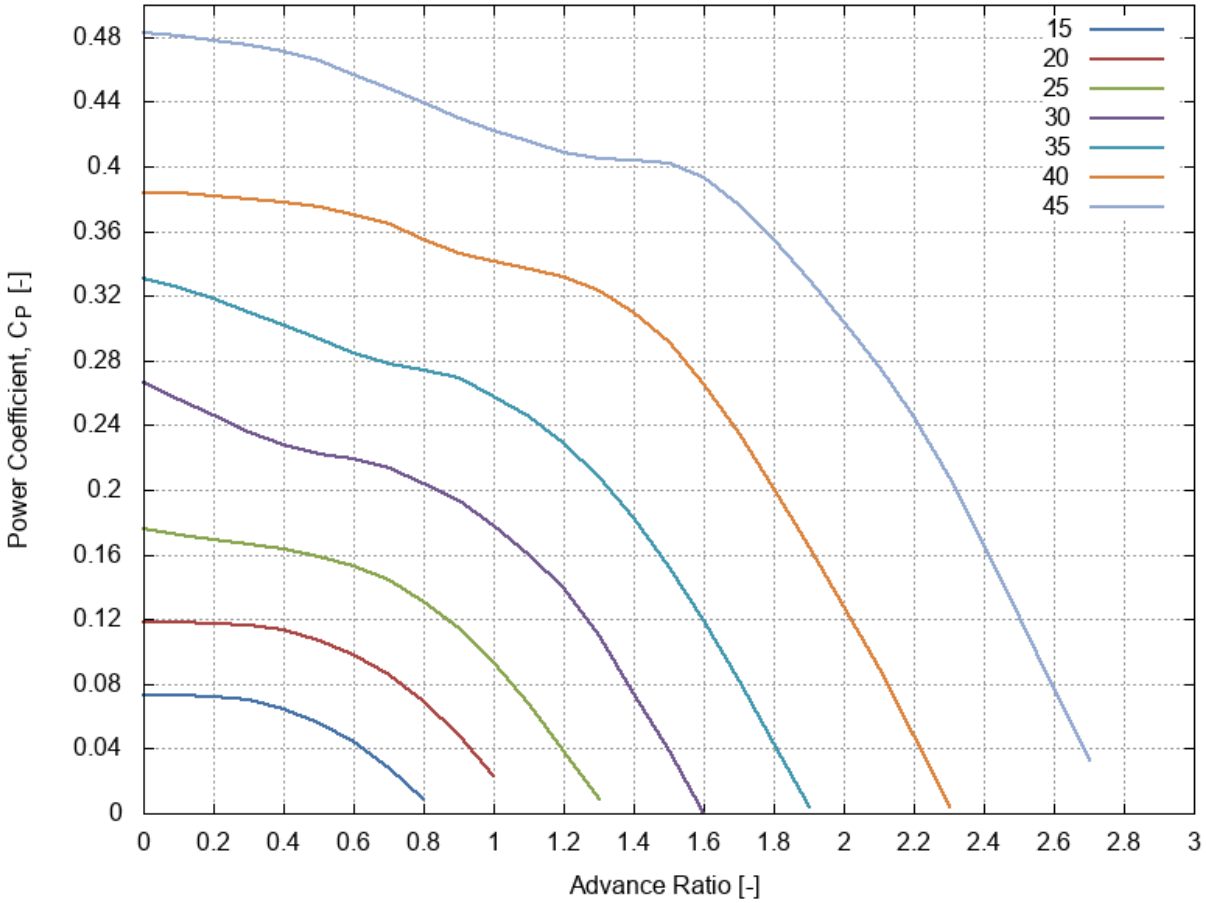
J\β0.75	15	20	25	30	35	40	45
3.5	-0.3991	-0.4600	-0.4848	-0.4757	-0.4417	-0.3952	-0.3289
3.6	-0.4167	-0.4820	-0.5117	-0.5051	-0.4715	-0.4245	-0.3592
3.7	-0.4344	-0.5041	-0.5387	-0.5344	-0.5012	-0.4537	-0.3895
3.8	-0.4520	-0.5262	-0.5656	-0.5638	-0.5310	-0.4829	-0.4198
3.9	-0.4697	-0.5482	-0.5926	-0.5931	-0.5608	-0.5121	-0.4501
4.0	-0.4873	-0.5703	-0.6196	-0.6225	-0.5905	-0.5414	-0.4804
4.1	-0.5098	-0.5977	-0.6511	-0.6581	-0.6273	-0.5779	-0.5160
4.2	-0.5323	-0.6251	-0.6825	-0.6937	-0.6640	-0.6145	-0.5516
4.3	-0.5548	-0.6526	-0.7140	-0.7293	-0.7008	-0.6510	-0.5872
4.4	-0.5773	-0.6800	-0.7455	-0.7649	-0.7375	-0.6875	-0.6228
4.5	-0.5998	-0.7074	-0.7770	-0.8005	-0.7743	-0.7241	-0.6584
4.6	-0.6223	-0.7348	-0.8085	-0.8361	-0.8110	-0.7606	-0.6941
4.7	-0.6448	-0.7623	-0.8399	-0.8717	-0.8478	-0.7972	-0.7297
4.8	-0.6673	-0.7897	-0.8714	-0.9073	-0.8845	-0.8337	-0.7653
4.9	-0.6898	-0.8171	-0.9029	-0.9429	-0.9213	-0.8702	-0.8009
5.0	-0.7123	-0.8445	-0.9344	-0.9785	-0.9580	-0.9068	-0.8365

Combined power coefficient [1], [3]

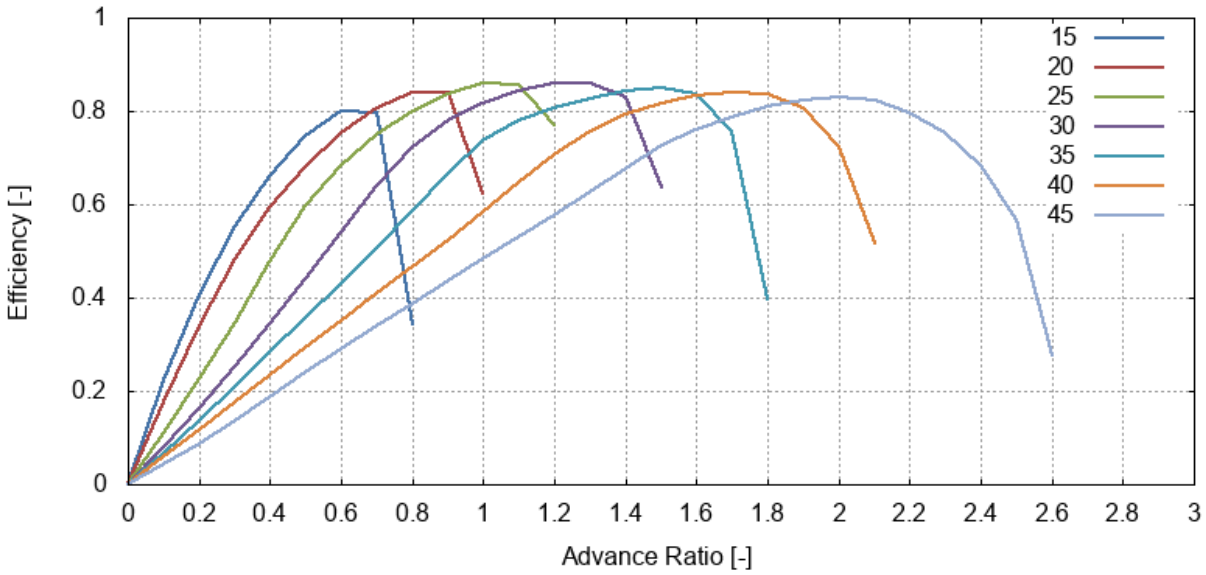
5. US Navy Bureau of Aeronautics propeller 5868-9, 4 blades



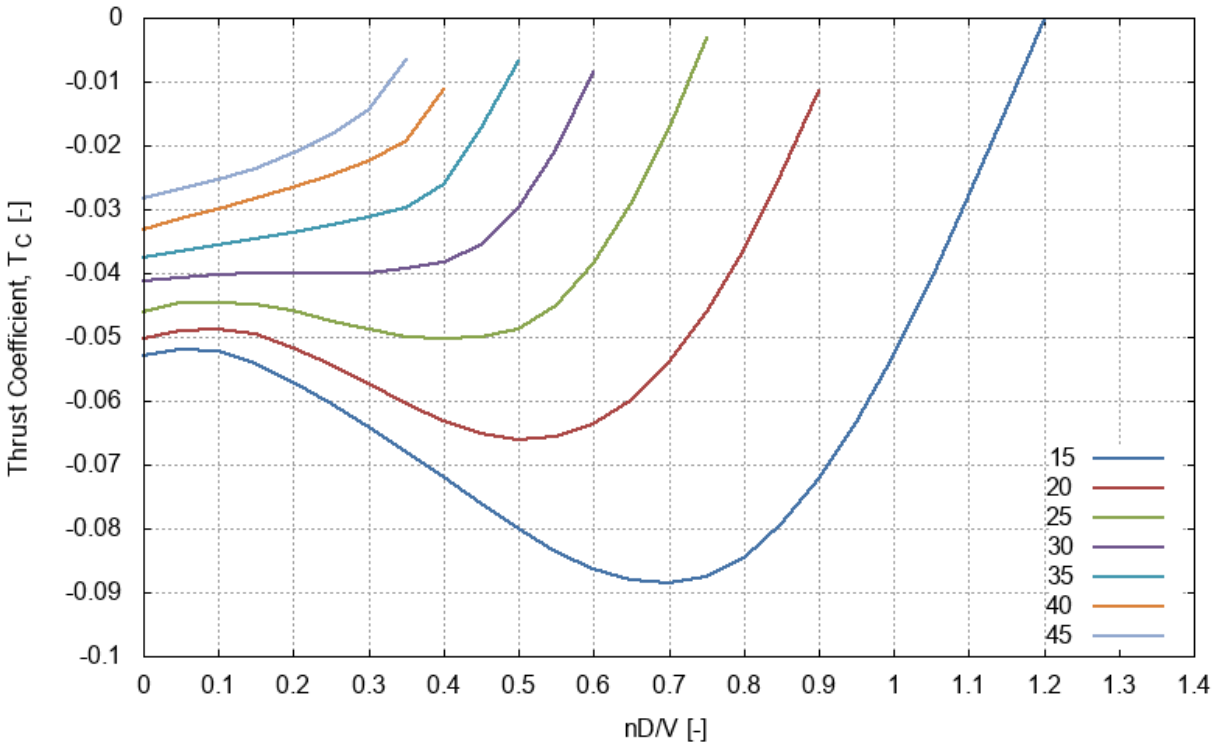
Thrust coefficient [2]



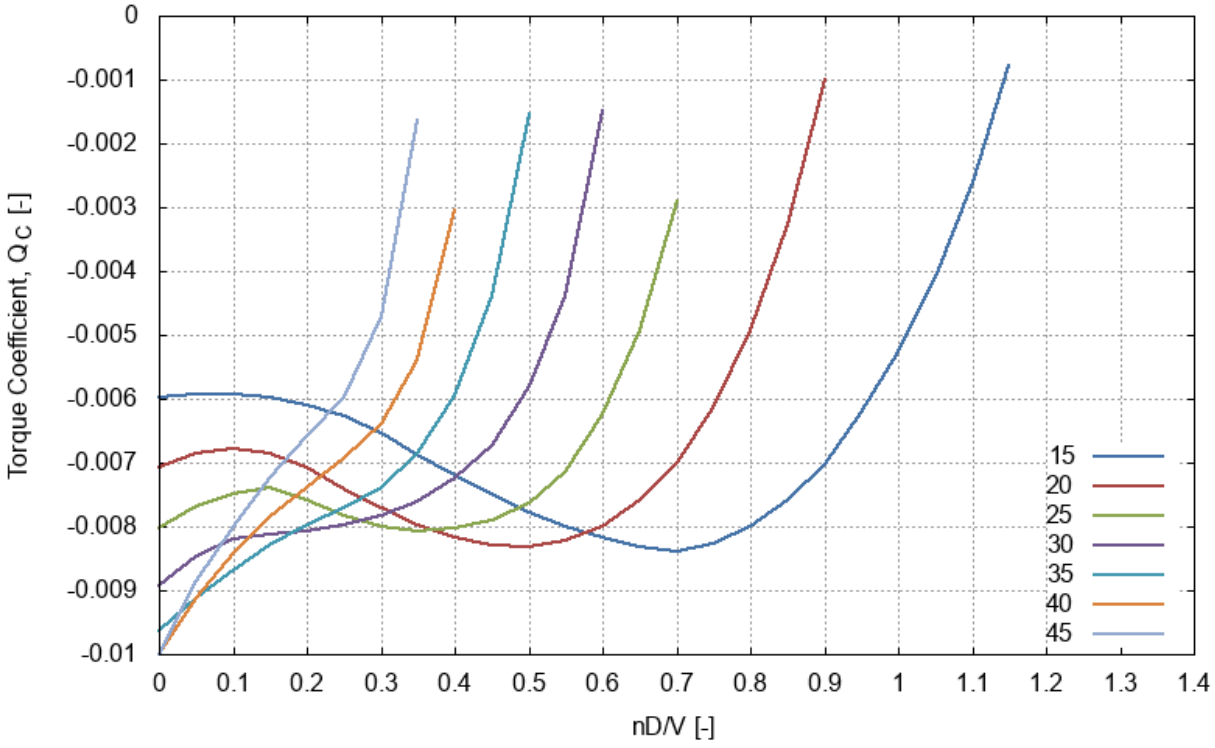
Power coefficient [2]



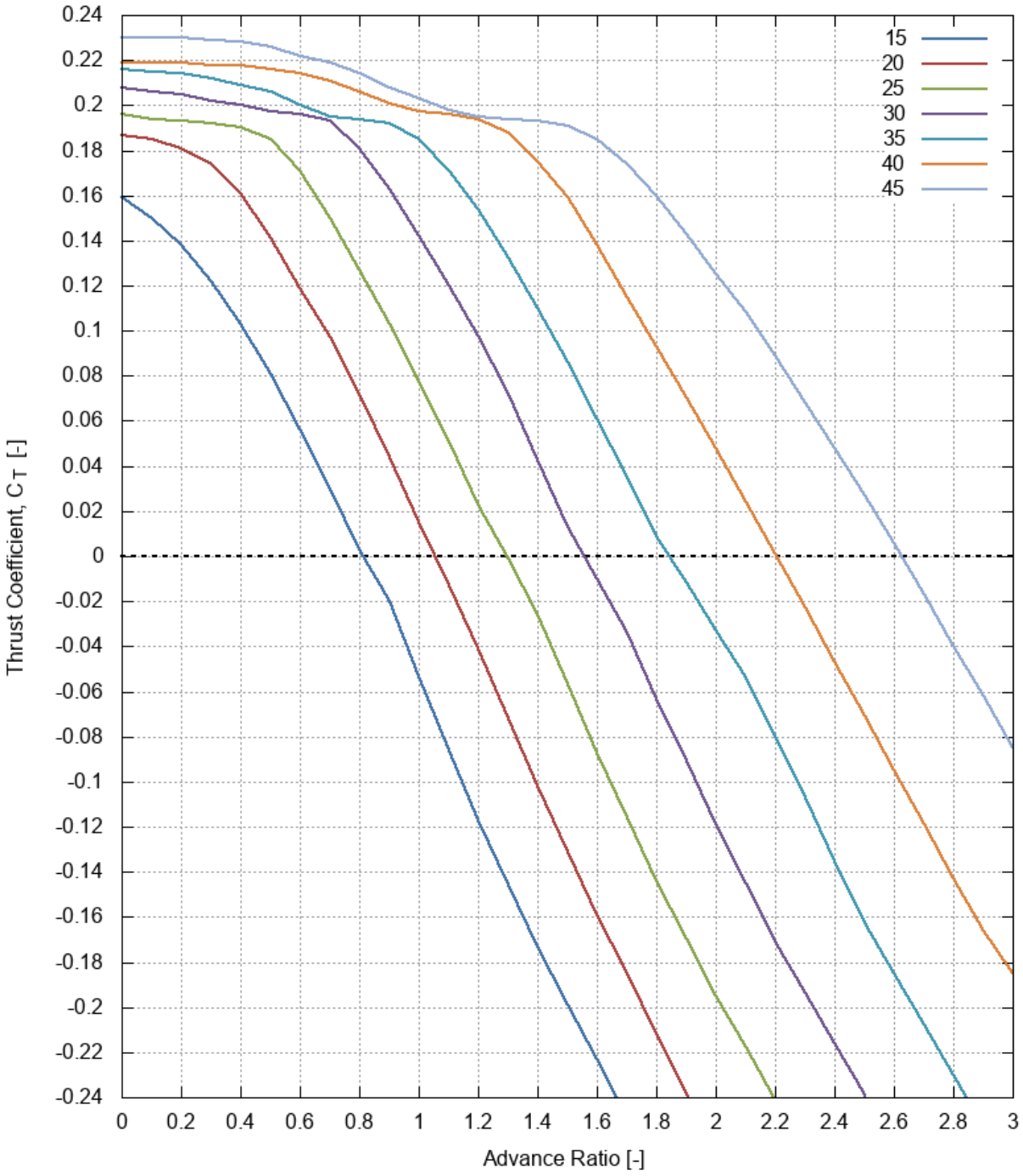
Efficiency [2]



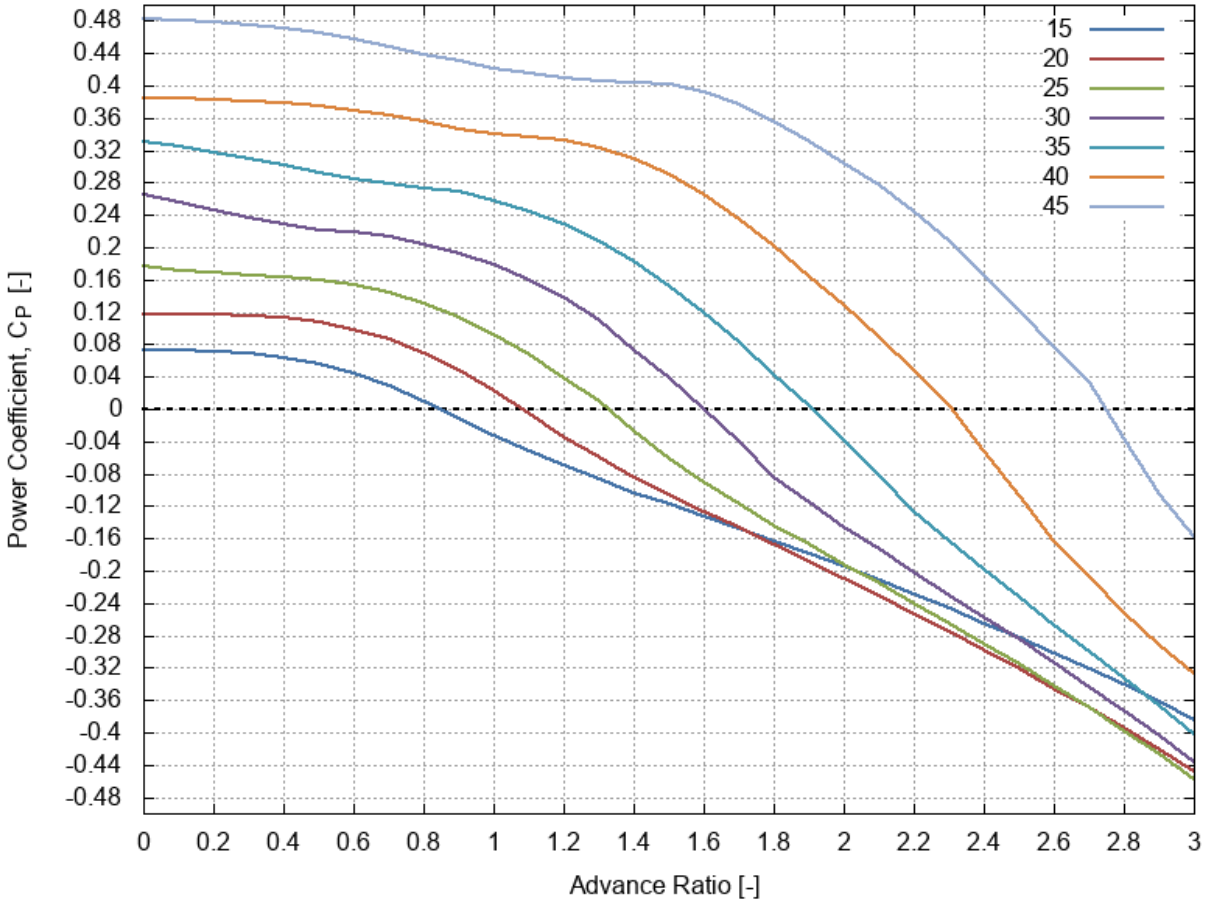
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [2], [3]



Combined power coefficient [2], [3]

5.1. Thrust Coefficient, C_T

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.159	0.187	0.196	0.208	0.216	0.219	0.230
0.1	0.150	0.185	0.194	0.206	0.215	0.219	0.230
0.2	0.138	0.181	0.193	0.205	0.214	0.219	0.230
0.3	0.122	0.174	0.192	0.202	0.212	0.218	0.229
0.4	0.103	0.161	0.190	0.200	0.209	0.218	0.228
0.5	0.081	0.141	0.185	0.197	0.206	0.216	0.226
0.6	0.056	0.119	0.171	0.196	0.200	0.214	0.222
0.7	0.030	0.097	0.150	0.193	0.195	0.211	0.219
0.8	0.003	0.072	0.127	0.181	0.194	0.206	0.214
0.9		0.044	0.103	0.163	0.192	0.201	0.208
1.0		0.015	0.077	0.142	0.185	0.197	0.203
1.1			0.051	0.120	0.171	0.196	0.198
1.2			0.023	0.098	0.154	0.194	0.195
1.3				0.072	0.132	0.188	0.194
1.4				0.043	0.110	0.175	0.193
1.5				0.013	0.086	0.159	0.191
1.6					0.061	0.138	0.185
1.7					0.035	0.115	0.174
1.8					0.009	0.093	0.160
1.9						0.070	0.143
2.0						0.048	0.125
2.1						0.024	0.108
2.2						0.001	0.089
2.3							0.068
2.4							0.048
2.5							0.027
2.6							0.006

Thrust coefficient [2]

5.2. Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.073	0.118	0.176	0.266	0.331	0.384	0.483
0.1	0.073	0.118	0.172	0.256	0.325	0.384	0.481
0.2	0.072	0.117	0.169	0.246	0.318	0.382	0.478
0.3	0.070	0.116	0.166	0.236	0.310	0.380	0.475
0.4	0.064	0.113	0.163	0.228	0.302	0.378	0.471
0.5	0.056	0.107	0.159	0.222	0.293	0.375	0.465
0.6	0.044	0.098	0.153	0.219	0.285	0.370	0.457
0.7	0.028	0.086	0.144	0.213	0.278	0.364	0.448
0.8	0.009	0.069	0.131	0.204	0.274	0.355	0.439
0.9		0.048	0.114	0.193	0.269	0.346	0.430
1.0		0.023	0.093	0.178	0.258	0.341	0.422
1.1			0.067	0.160	0.245	0.337	0.415
1.2			0.038	0.139	0.229	0.332	0.409
1.3			0.009	0.110	0.208	0.323	0.405
1.4				0.074	0.183	0.310	0.404
1.5				0.038	0.152	0.291	0.402
1.6				0.000	0.119	0.265	0.393
1.7					0.082	0.235	0.376
1.8					0.043	0.201	0.355
1.9					0.004	0.164	0.330
2.0						0.128	0.304
2.1						0.089	0.276
2.2						0.048	0.245
2.3						0.004	0.208
2.4							0.165
2.5							0.121
2.6							0.077
2.7							0.033

Power coefficient [2]

5.3. Efficiency, η

J\β0.75	15	20	25	30	35	40	45
0.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.222	0.178	0.110	0.081	0.068	0.059	0.043
0.2	0.406	0.340	0.226	0.164	0.136	0.117	0.088
0.3	0.553	0.482	0.348	0.252	0.209	0.176	0.136
0.4	0.661	0.592	0.477	0.344	0.283	0.234	0.188
0.5	0.745	0.681	0.595	0.439	0.356	0.292	0.241
0.6	0.799	0.752	0.684	0.540	0.431	0.350	0.291
0.7	0.796	0.806	0.750	0.641	0.506	0.409	0.339
0.8	0.342	0.840	0.801	0.724	0.585	0.467	0.388
0.9		0.839	0.838	0.780	0.665	0.524	0.437
1.0		0.624	0.859	0.817	0.735	0.584	0.483
1.1			0.855	0.843	0.780	0.647	0.530
1.2			0.771	0.860	0.808	0.706	0.578
1.3				0.860	0.828	0.756	0.626
1.4				0.829	0.842	0.792	0.677
1.5				0.638	0.850	0.817	0.725
1.6					0.838	0.832	0.761
1.7					0.758	0.840	0.788
1.8					0.396	0.835	0.810
1.9						0.805	0.824
2.0						0.723	0.830
2.1						0.518	0.822
2.2							0.798
2.3							0.752
2.4							0.682
2.5							0.566
2.6							0.276

Efficiency [2]

5.4. Negative Thrust Coefficient, T_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.053	-0.050	-0.046	-0.041	-0.037	-0.033	-0.028
0.05	-0.052	-0.049	-0.045	-0.041	-0.037	-0.031	-0.027
0.10	-0.052	-0.049	-0.045	-0.040	-0.036	-0.030	-0.025
0.15	-0.054	-0.050	-0.045	-0.040	-0.035	-0.028	-0.024
0.20	-0.057	-0.052	-0.046	-0.040	-0.034	-0.027	-0.021
0.25	-0.061	-0.054	-0.047	-0.040	-0.033	-0.025	-0.018
0.30	-0.064	-0.057	-0.049	-0.040	-0.031	-0.022	-0.014
0.35	-0.068	-0.060	-0.050	-0.039	-0.030	-0.019	-0.006
0.40	-0.072	-0.063	-0.050	-0.038	-0.026	-0.011	
0.45	-0.076	-0.065	-0.050	-0.036	-0.017		
0.50	-0.080	-0.066	-0.049	-0.030	-0.007		
0.55	-0.084	-0.066	-0.045	-0.021			
0.60	-0.086	-0.064	-0.038	-0.009			
0.65	-0.088	-0.060	-0.029				
0.70	-0.088	-0.054	-0.017				
0.75	-0.087	-0.046	-0.003				
0.80	-0.085	-0.036					
0.85	-0.079	-0.024					
0.90	-0.072	-0.011					
0.95	-0.064						
1.00	-0.053						
1.05	-0.041						
1.10	-0.028						
1.15	-0.015						
1.20	0.000						

Negative thrust coefficient [3]

5.5. Negative Torque Coefficient, Q_C

nD/V\β0.75	15	20	25	30	35	40	45
0.00	-0.0060	-0.0071	-0.0080	-0.0089	-0.0096	-0.0100	-0.0100
0.05	-0.0059	-0.0069	-0.0077	-0.0085	-0.0091	-0.0091	-0.0089
0.10	-0.0059	-0.0068	-0.0075	-0.0082	-0.0087	-0.0084	-0.0080
0.15	-0.0060	-0.0068	-0.0074	-0.0081	-0.0083	-0.0079	-0.0072
0.20	-0.0061	-0.0071	-0.0076	-0.0081	-0.0080	-0.0074	-0.0066
0.25	-0.0063	-0.0074	-0.0078	-0.0080	-0.0077	-0.0069	-0.0060
0.30	-0.0065	-0.0077	-0.0080	-0.0078	-0.0074	-0.0064	-0.0047
0.35	-0.0069	-0.0080	-0.0081	-0.0076	-0.0069	-0.0054	-0.0016
0.40	-0.0072	-0.0082	-0.0080	-0.0072	-0.0059	-0.0031	
0.45	-0.0075	-0.0083	-0.0079	-0.0067	-0.0044		
0.50	-0.0078	-0.0083	-0.0076	-0.0058	-0.0015		
0.55	-0.0080	-0.0082	-0.0071	-0.0044			
0.60	-0.0082	-0.0080	-0.0063	-0.0015			
0.65	-0.0083	-0.0076	-0.0049				
0.70	-0.0084	-0.0070	-0.0029				
0.75	-0.0083	-0.0061					
0.80	-0.0080	-0.0049					
0.85	-0.0076	-0.0033					
0.90	-0.0070	-0.0010					
0.95	-0.0062						
1.00	-0.0053						
1.05	-0.0041						
1.10	-0.0026						
1.15	-0.0008						

Negative torque coefficient [3]

5.6. Combined Thrust Coefficient, C_T

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.159	0.187	0.196	0.208	0.216	0.219	0.230
0.1	0.150	0.185	0.194	0.206	0.215	0.219	0.230
0.2	0.138	0.181	0.193	0.205	0.214	0.219	0.230
0.3	0.122	0.174	0.192	0.202	0.212	0.218	0.229
0.4	0.103	0.161	0.190	0.200	0.209	0.218	0.228
0.5	0.081	0.141	0.185	0.197	0.206	0.216	0.226
0.6	0.056	0.119	0.171	0.196	0.200	0.214	0.222
0.7	0.030	0.097	0.150	0.193	0.195	0.211	0.219
0.8	0.003	0.072	0.127	0.181	0.194	0.206	0.214
0.9	-0.020	0.044	0.103	0.163	0.192	0.201	0.208
1.0	-0.053	0.015	0.077	0.142	0.185	0.197	0.203
1.1	-0.086	-0.013	0.051	0.120	0.171	0.196	0.198
1.2	-0.117	-0.041	0.023	0.098	0.154	0.194	0.195
1.3	-0.146	-0.072	-0.001	0.072	0.132	0.188	0.194
1.4	-0.173	-0.102	-0.026	0.043	0.110	0.175	0.193
1.5	-0.199	-0.131	-0.057	0.013	0.086	0.159	0.191
1.6	-0.223	-0.159	-0.087	-0.010	0.061	0.138	0.185
1.7	-0.248	-0.185	-0.116	-0.034	0.035	0.115	0.174
1.8	-0.272	-0.212	-0.144	-0.063	0.009	0.093	0.160
1.9	-0.296	-0.238	-0.170	-0.091	-0.012	0.070	0.143
2.0	-0.320	-0.264	-0.195	-0.119	-0.033	0.048	0.125
2.1	-0.345	-0.290	-0.218	-0.145	-0.054	0.024	0.108
2.2	-0.370	-0.316	-0.241	-0.171	-0.080	0.001	0.089
2.3	-0.396	-0.342	-0.265	-0.194	-0.107	-0.023	0.068
2.4	-0.423	-0.368	-0.290	-0.216	-0.135	-0.047	0.048
2.5	-0.450	-0.394	-0.314	-0.239	-0.163	-0.071	0.027
2.6	-0.479	-0.422	-0.340	-0.262	-0.185	-0.095	0.006
2.7	-0.509	-0.450	-0.366	-0.285	-0.208	-0.119	-0.017
2.8	-0.538	-0.478	-0.392	-0.308	-0.230	-0.143	-0.040
2.9	-0.569	-0.506	-0.420	-0.332	-0.253	-0.166	-0.062
3.0	-0.602	-0.537	-0.448	-0.358	-0.275	-0.185	-0.085
3.1	-0.635	-0.567	-0.477	-0.383	-0.297	-0.205	-0.108
3.2	-0.668	-0.597	-0.505	-0.409	-0.319	-0.224	-0.130
3.3	-0.701	-0.627	-0.534	-0.435	-0.341	-0.243	-0.153
3.4	-0.738	-0.661	-0.565	-0.463	-0.365	-0.264	-0.173

$J\backslash\beta_{0.75}$	15	20	25	30	35	40	45
3.5	-0.776	-0.696	-0.597	-0.492	-0.391	-0.286	-0.193
3.6	-0.815	-0.731	-0.630	-0.522	-0.417	-0.308	-0.213
3.7	-0.853	-0.766	-0.662	-0.551	-0.443	-0.330	-0.232
3.8	-0.892	-0.801	-0.695	-0.581	-0.469	-0.351	-0.252
3.9	-0.930	-0.836	-0.727	-0.610	-0.495	-0.373	-0.271
4.0	-0.969	-0.871	-0.760	-0.639	-0.521	-0.395	-0.291
4.1	-1.015	-0.913	-0.799	-0.675	-0.553	-0.422	-0.315
4.2	-1.061	-0.955	-0.837	-0.711	-0.585	-0.449	-0.338
4.3	-1.107	-0.998	-0.876	-0.747	-0.617	-0.476	-0.362
4.4	-1.153	-1.040	-0.915	-0.784	-0.649	-0.503	-0.386
4.5	-1.199	-1.082	-0.954	-0.820	-0.681	-0.530	-0.410
4.6	-1.245	-1.124	-0.993	-0.856	-0.713	-0.557	-0.434
4.7	-1.291	-1.166	-1.032	-0.892	-0.745	-0.584	-0.457
4.8	-1.338	-1.208	-1.071	-0.928	-0.777	-0.611	-0.481
4.9	-1.384	-1.250	-1.110	-0.964	-0.809	-0.639	-0.505
5.0	-1.430	-1.292	-1.149	-1.000	-0.841	-0.666	-0.529

Combined thrust coefficient [2], [3]

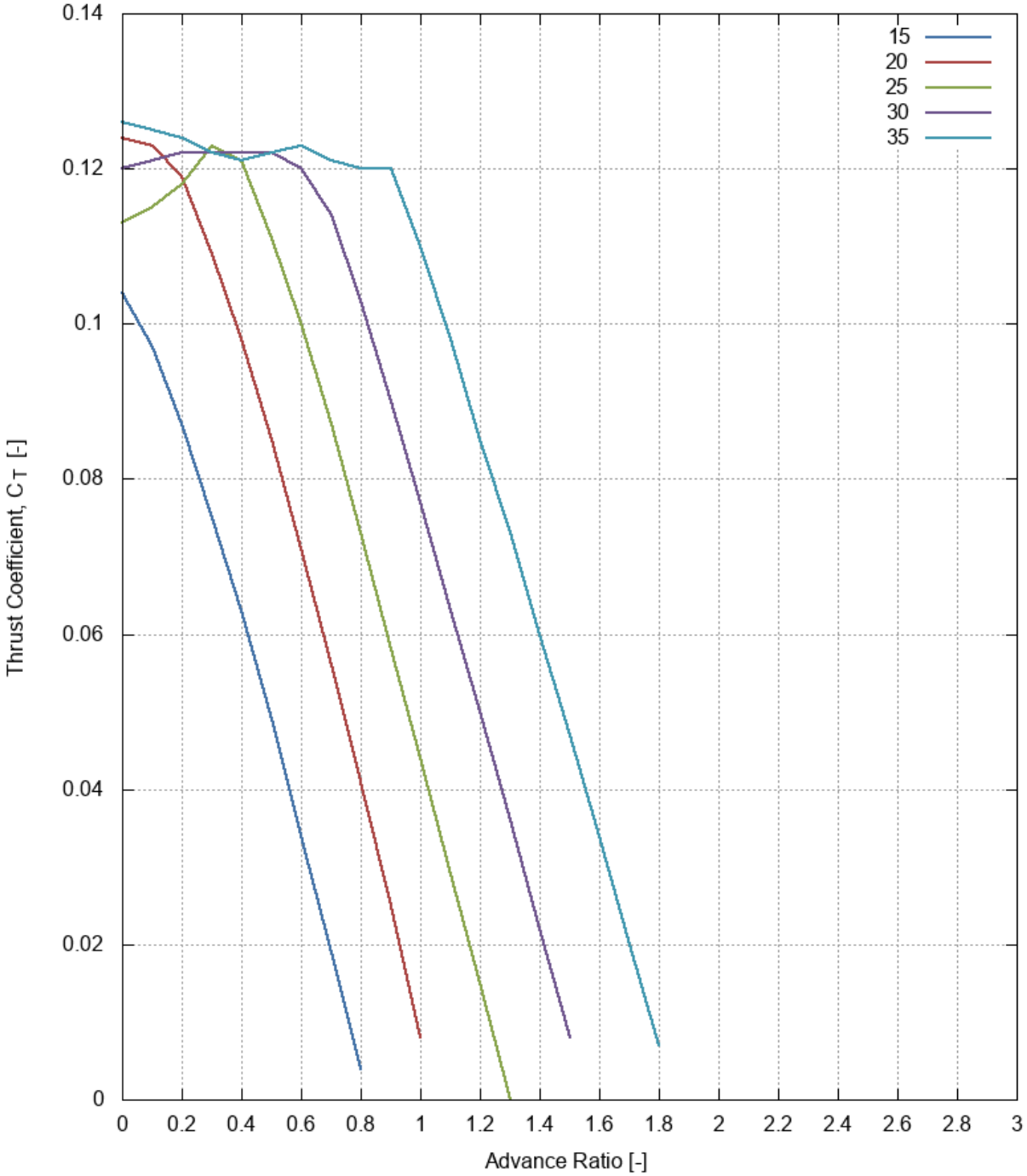
5.7. Combined Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40	45
0.0	0.073	0.118	0.176	0.266	0.331	0.384	0.483
0.1	0.073	0.118	0.172	0.256	0.325	0.384	0.481
0.2	0.072	0.117	0.169	0.246	0.318	0.382	0.478
0.3	0.070	0.116	0.166	0.236	0.310	0.380	0.475
0.4	0.064	0.113	0.163	0.228	0.302	0.378	0.471
0.5	0.056	0.107	0.159	0.222	0.293	0.375	0.465
0.6	0.044	0.098	0.153	0.219	0.285	0.370	0.457
0.7	0.028	0.086	0.144	0.213	0.278	0.364	0.448
0.8	0.009	0.069	0.131	0.204	0.274	0.355	0.439
0.9	-0.011	0.048	0.114	0.193	0.269	0.346	0.430
1.0	-0.033	0.023	0.093	0.178	0.258	0.341	0.422
1.1	-0.052	-0.006	0.067	0.160	0.245	0.337	0.415
1.2	-0.070	-0.035	0.038	0.139	0.229	0.332	0.409
1.3	-0.087	-0.060	0.009	0.110	0.208	0.323	0.405
1.4	-0.103	-0.084	-0.026	0.074	0.183	0.310	0.404
1.5	-0.118	-0.105	-0.061	0.038	0.152	0.291	0.402
1.6	-0.133	-0.126	-0.090	0.000	0.119	0.265	0.393
1.7	-0.148	-0.146	-0.118	-0.040	0.082	0.235	0.376
1.8	-0.163	-0.167	-0.144	-0.084	0.043	0.201	0.355
1.9	-0.179	-0.188	-0.168	-0.116	0.004	0.164	0.330
2.0	-0.195	-0.209	-0.192	-0.146	-0.039	0.128	0.304
2.1	-0.212	-0.231	-0.216	-0.174	-0.082	0.089	0.276
2.2	-0.229	-0.253	-0.240	-0.202	-0.126	0.048	0.245
2.3	-0.247	-0.275	-0.265	-0.230	-0.163	0.004	0.208
2.4	-0.265	-0.298	-0.290	-0.257	-0.198	-0.052	0.165
2.5	-0.282	-0.321	-0.315	-0.285	-0.233	-0.108	0.121
2.6	-0.302	-0.346	-0.343	-0.314	-0.267	-0.164	0.077
2.7	-0.322	-0.370	-0.370	-0.344	-0.300	-0.208	0.033
2.8	-0.341	-0.395	-0.398	-0.373	-0.333	-0.252	-0.036
2.9	-0.362	-0.421	-0.427	-0.404	-0.367	-0.292	-0.106
3.0	-0.384	-0.448	-0.457	-0.437	-0.401	-0.327	-0.157
3.1	-0.405	-0.475	-0.488	-0.470	-0.435	-0.363	-0.209
3.2	-0.427	-0.502	-0.518	-0.503	-0.470	-0.398	-0.260
3.3	-0.449	-0.530	-0.549	-0.536	-0.504	-0.434	-0.312
3.4	-0.474	-0.559	-0.582	-0.572	-0.542	-0.471	-0.356

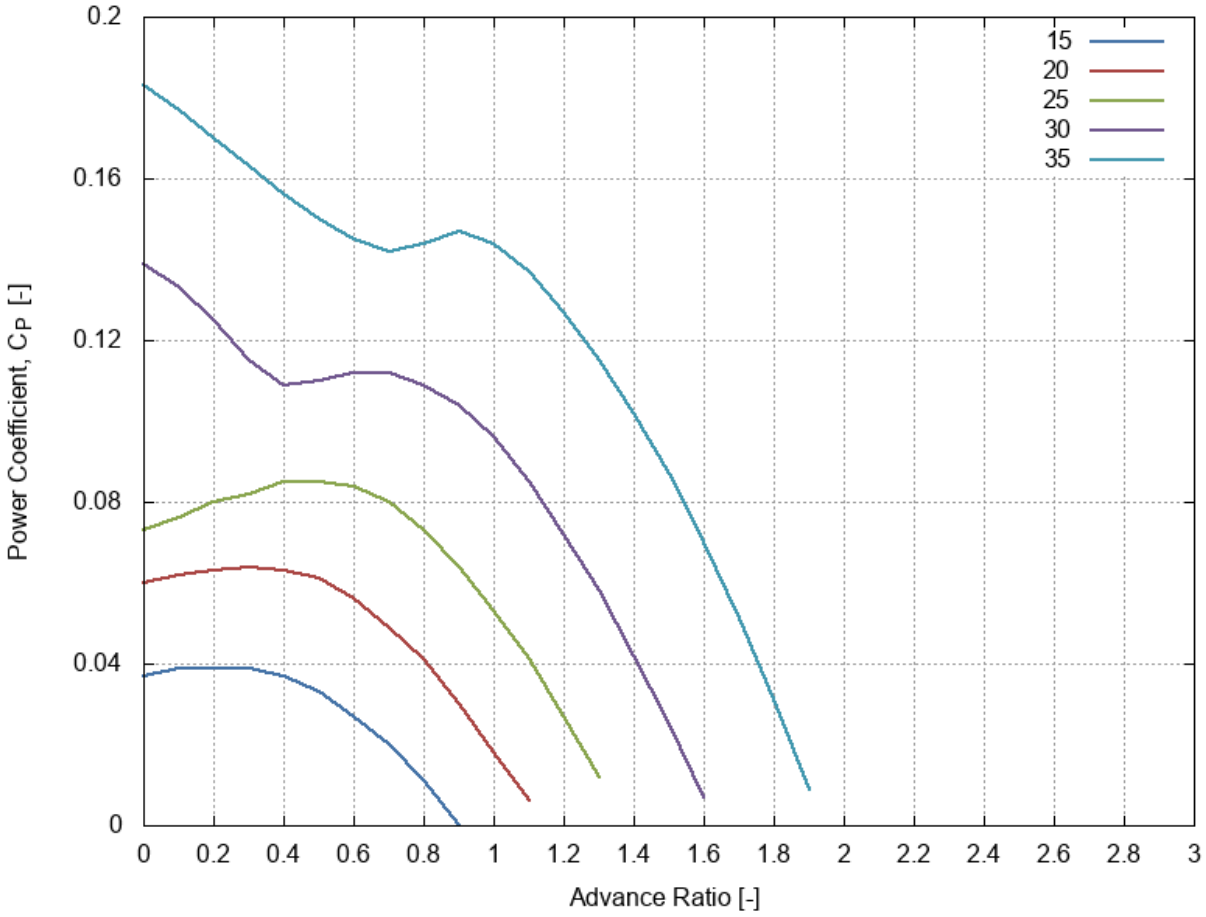
$J\backslash\beta_{0.75}$	15	20	25	30	35	40	45
3.5	-0.500	-0.590	-0.616	-0.611	-0.581	-0.508	-0.397
3.6	-0.526	-0.621	-0.650	-0.649	-0.619	-0.546	-0.438
3.7	-0.552	-0.652	-0.684	-0.688	-0.658	-0.583	-0.479
3.8	-0.578	-0.683	-0.718	-0.726	-0.697	-0.621	-0.520
3.9	-0.604	-0.714	-0.752	-0.765	-0.736	-0.659	-0.561
4.0	-0.630	-0.745	-0.787	-0.803	-0.775	-0.696	-0.601
4.1	-0.663	-0.782	-0.827	-0.850	-0.823	-0.743	-0.645
4.2	-0.695	-0.819	-0.868	-0.896	-0.871	-0.789	-0.688
4.3	-0.728	-0.856	-0.908	-0.943	-0.919	-0.835	-0.732
4.4	-0.760	-0.892	-0.948	-0.990	-0.967	-0.882	-0.775
4.5	-0.793	-0.929	-0.989	-1.036	-1.015	-0.928	-0.819
4.6	-0.826	-0.966	-1.029	-1.083	-1.063	-0.975	-0.862
4.7	-0.858	-1.003	-1.070	-1.130	-1.111	-1.021	-0.906
4.8	-0.891	-1.039	-1.110	-1.176	-1.159	-1.067	-0.949
4.9	-0.923	-1.076	-1.151	-1.223	-1.207	-1.114	-0.993
5.0	-0.956	-1.113	-1.191	-1.270	-1.255	-1.160	-1.036

Combined power coefficient [2], [3]

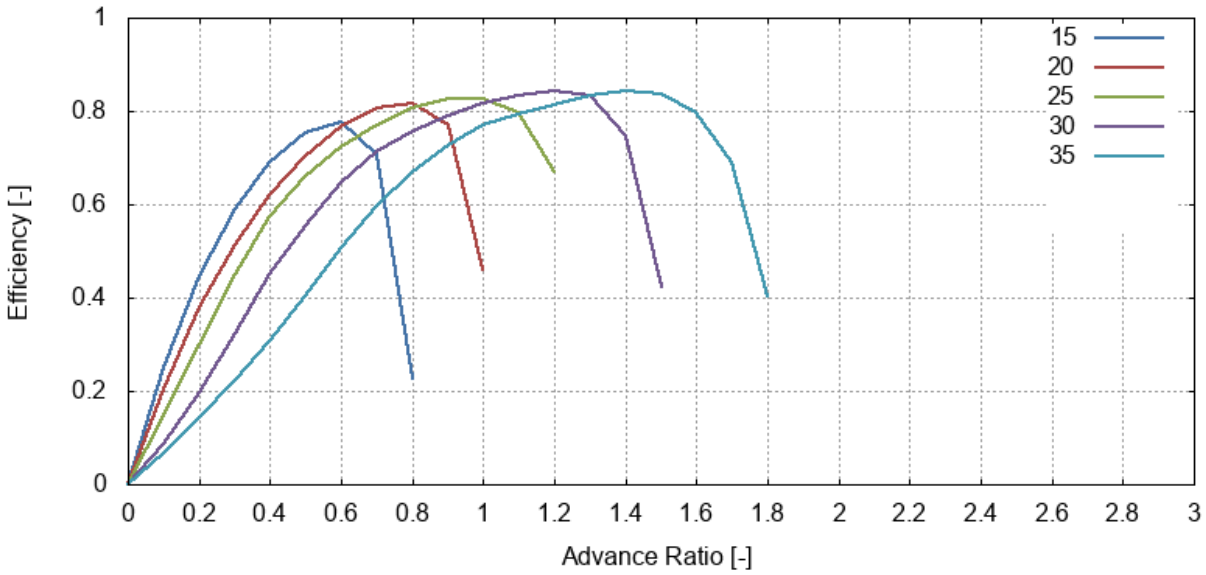
6. US Navy Bureau of Aeronautics propeller 5868-R6, 2 blades



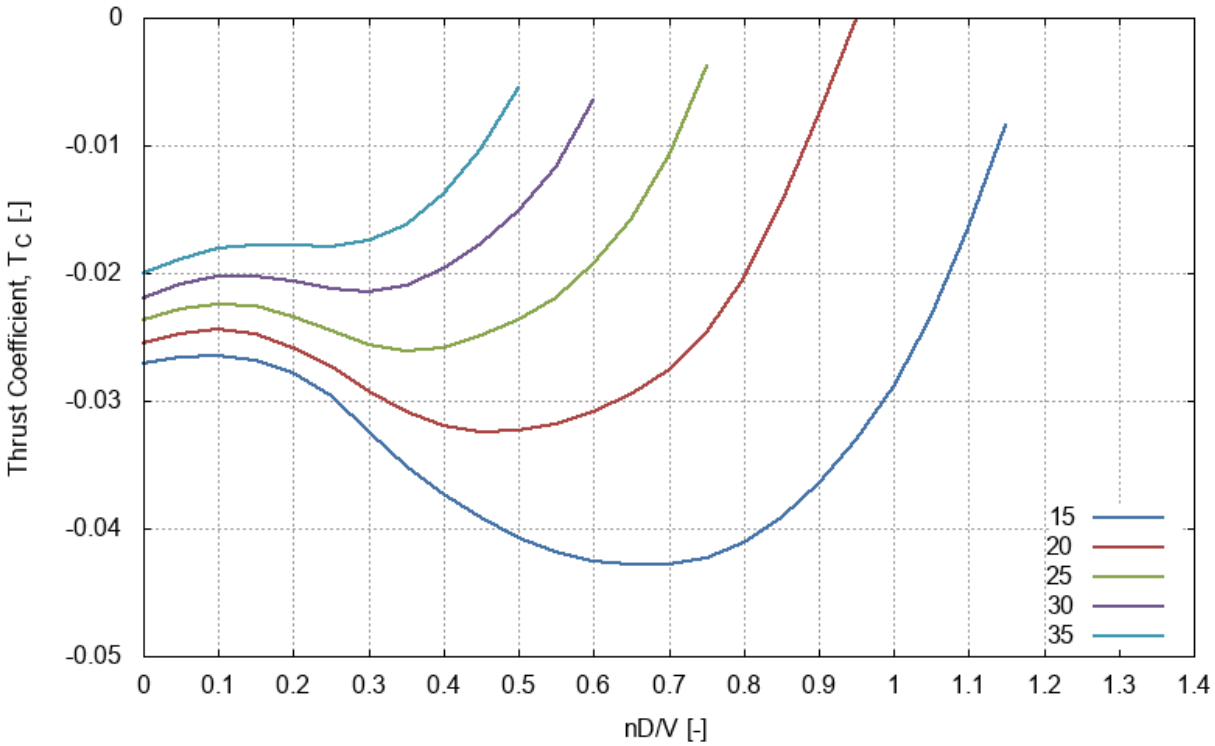
Thrust coefficient [2]



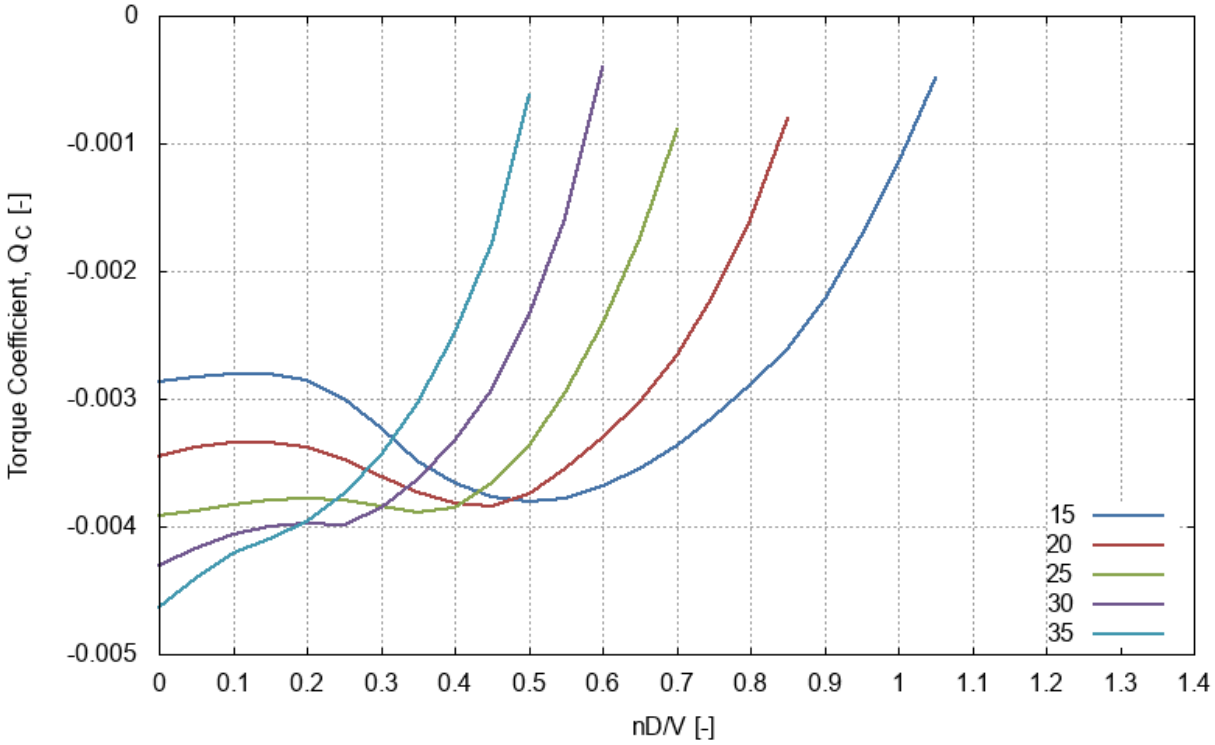
Power coefficient [2]



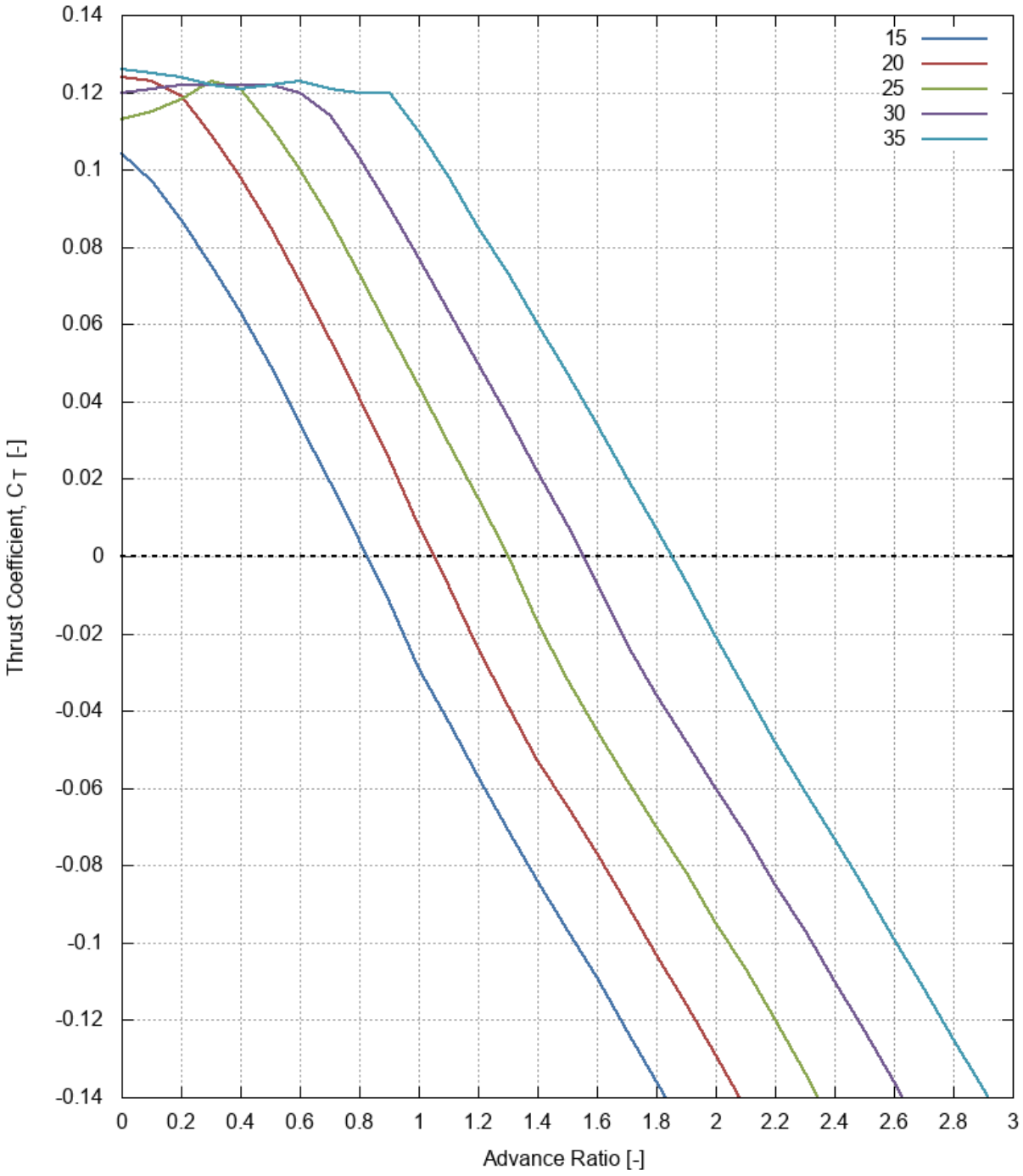
Efficiency [2]



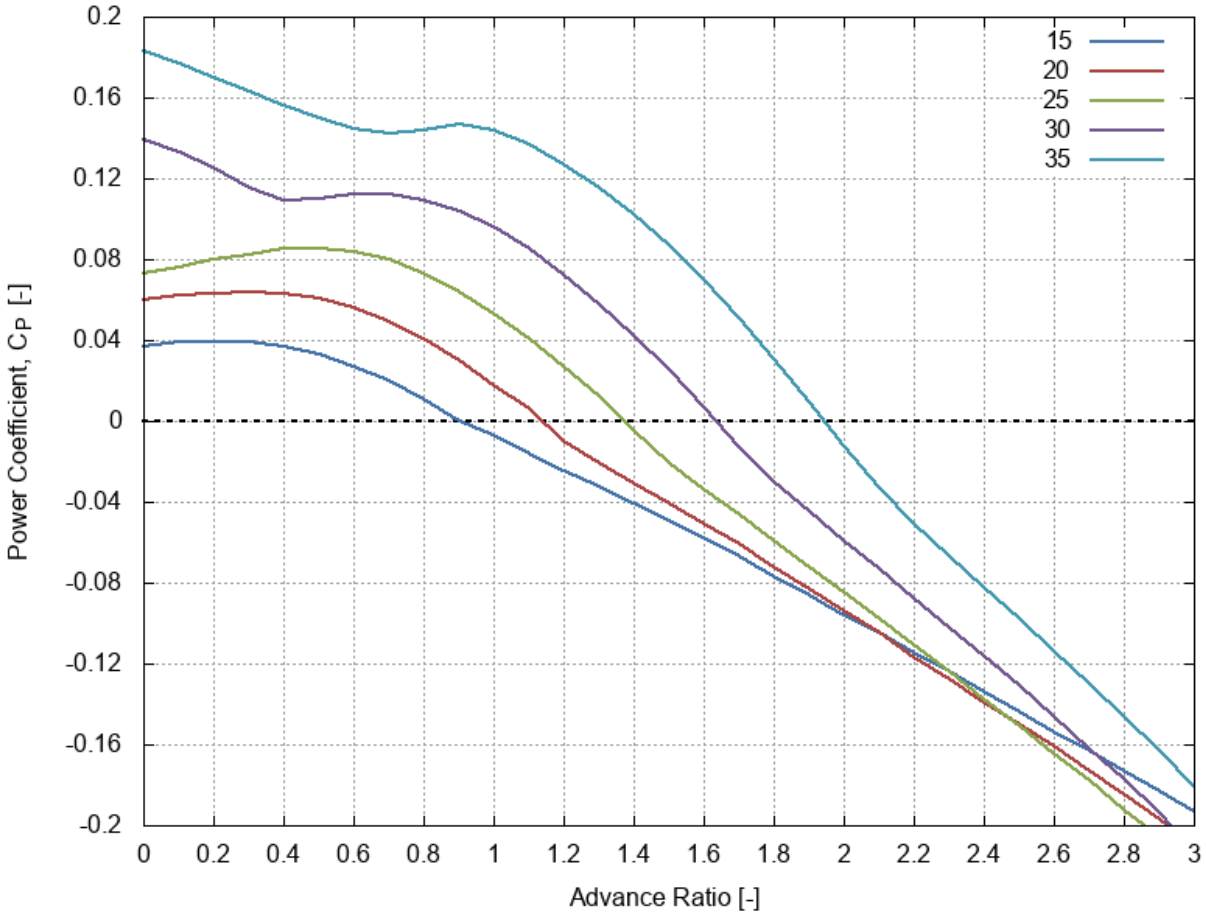
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [2], [3]



Combined power coefficient [2], [3]

6.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35
0.0	0.104	0.124	0.113	0.120	0.126
0.1	0.097	0.123	0.115	0.121	0.125
0.2	0.087	0.119	0.118	0.122	0.124
0.3	0.075	0.109	0.123	0.122	0.122
0.4	0.063	0.098	0.121	0.122	0.121
0.5	0.049	0.085	0.111	0.122	0.122
0.6	0.034	0.071	0.100	0.120	0.123
0.7	0.019	0.056	0.087	0.114	0.121
0.8	0.004	0.041	0.073	0.103	0.120
0.9		0.025	0.058	0.090	0.120
1.0		0.008	0.044	0.077	0.110
1.1			0.029	0.063	0.098
1.2			0.015	0.050	0.085
1.3			0.000	0.036	0.073
1.4				0.022	0.060
1.5				0.008	0.047
1.6					0.034
1.7					0.020
1.8					0.007

Thrust coefficient [2]

6.2. Power Coefficient, C_P

J\β0.75	15	20	25	30	35
0.0	0.037	0.060	0.073	0.139	0.183
0.1	0.039	0.062	0.076	0.133	0.177
0.2	0.039	0.063	0.080	0.125	0.170
0.3	0.039	0.064	0.082	0.115	0.163
0.4	0.037	0.063	0.085	0.109	0.156
0.5	0.033	0.061	0.085	0.110	0.150
0.6	0.027	0.056	0.084	0.112	0.145
0.7	0.020	0.049	0.080	0.112	0.142
0.8	0.011	0.041	0.073	0.109	0.144
0.9	0.000	0.030	0.064	0.104	0.147
1.0		0.018	0.053	0.096	0.144
1.1		0.006	0.041	0.085	0.137
1.2			0.027	0.072	0.127
1.3			0.012	0.058	0.115
1.4				0.042	0.102
1.5				0.025	0.087
1.6				0.007	0.070
1.7					0.051
1.8					0.031
1.9					0.009

Power coefficient [2]

6.3. Efficiency, η

J\β$_{0.75}$	15	20	25	30	35
0.0	0.000	0.000	0.000	0.000	0.000
0.1	0.250	0.204	0.148	0.086	0.067
0.2	0.446	0.380	0.300	0.196	0.143
0.3	0.590	0.513	0.451	0.323	0.222
0.4	0.689	0.620	0.574	0.451	0.308
0.5	0.753	0.703	0.661	0.554	0.402
0.6	0.777	0.767	0.723	0.647	0.505
0.7	0.706	0.807	0.771	0.714	0.596
0.8	0.228	0.816	0.807	0.758	0.671
0.9		0.769	0.827	0.789	0.728
1.0		0.461	0.827	0.815	0.769
1.1			0.796	0.833	0.793
1.2			0.669	0.842	0.814
1.3				0.832	0.832
1.4				0.747	0.842
1.5				0.424	0.835
1.6					0.798
1.7					0.689
1.8					0.404

Efficiency [2]

6.4. Negative Thrust Coefficient, T_C

nD/V\β$_{0.75}$	15	20	25	30	35
0.00	-0.027	-0.025	-0.024	-0.022	-0.020
0.05	-0.027	-0.025	-0.023	-0.021	-0.019
0.10	-0.026	-0.024	-0.022	-0.020	-0.018
0.15	-0.027	-0.025	-0.023	-0.020	-0.018
0.20	-0.028	-0.026	-0.023	-0.021	-0.018
0.25	-0.030	-0.027	-0.025	-0.021	-0.018
0.30	-0.032	-0.029	-0.026	-0.021	-0.017
0.35	-0.035	-0.031	-0.026	-0.021	-0.016
0.40	-0.037	-0.032	-0.026	-0.020	-0.014
0.45	-0.039	-0.032	-0.025	-0.018	-0.010
0.50	-0.041	-0.032	-0.024	-0.015	-0.005
0.55	-0.042	-0.032	-0.022	-0.012	
0.60	-0.043	-0.031	-0.019	-0.007	
0.65	-0.043	-0.030	-0.016		
0.70	-0.043	-0.028	-0.011		
0.75	-0.042	-0.025	-0.004		
0.80	-0.041	-0.020			
0.85	-0.039	-0.014			
0.90	-0.036	-0.008			
0.95	-0.033	0.000			
1.00	-0.029				
1.05	-0.023				
1.10	-0.016				
1.15	-0.008				

Negative thrust coefficient [3]

6.5. Negative Torque Coefficient, Q_C

$nD/V \backslash \beta_{0.75}$	15	20	25	30	35
0.00	-0.0029	-0.0035	-0.0039	-0.0043	-0.0046
0.05	-0.0028	-0.0034	-0.0039	-0.0042	-0.0044
0.10	-0.0028	-0.0033	-0.0038	-0.0041	-0.0042
0.15	-0.0028	-0.0033	-0.0038	-0.0040	-0.0041
0.20	-0.0029	-0.0034	-0.0038	-0.0040	-0.0040
0.25	-0.0030	-0.0035	-0.0038	-0.0040	-0.0037
0.30	-0.0032	-0.0036	-0.0038	-0.0039	-0.0034
0.35	-0.0035	-0.0037	-0.0039	-0.0036	-0.0030
0.40	-0.0037	-0.0038	-0.0039	-0.0033	-0.0025
0.45	-0.0038	-0.0038	-0.0037	-0.0029	-0.0018
0.50	-0.0038	-0.0037	-0.0034	-0.0023	-0.0006
0.55	-0.0038	-0.0035	-0.0029	-0.0016	
0.60	-0.0037	-0.0033	-0.0024	-0.0004	
0.65	-0.0036	-0.0030	-0.0017		
0.70	-0.0034	-0.0027	-0.0009		
0.75	-0.0031	-0.0022			
0.80	-0.0029	-0.0016			
0.85	-0.0026	-0.0008			
0.90	-0.0022				
0.95	-0.0017				
1.00	-0.0012				
1.05	-0.0005				

Negative torque coefficient [3]

6.6. Combined Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35
0.0	0.104	0.124	0.113	0.120	0.126
0.1	0.097	0.123	0.115	0.121	0.125
0.2	0.087	0.119	0.118	0.122	0.124
0.3	0.075	0.109	0.123	0.122	0.122
0.4	0.063	0.098	0.121	0.122	0.121
0.5	0.049	0.085	0.111	0.122	0.122
0.6	0.034	0.071	0.100	0.120	0.123
0.7	0.019	0.056	0.087	0.114	0.121
0.8	0.004	0.041	0.073	0.103	0.120
0.9	-0.012	0.025	0.058	0.090	0.120
1.0	-0.029	0.008	0.044	0.077	0.110
1.1	-0.043	-0.008	0.029	0.063	0.098
1.2	-0.057	-0.024	0.015	0.050	0.085
1.3	-0.071	-0.039	0.000	0.036	0.073
1.4	-0.084	-0.053	-0.017	0.022	0.060
1.5	-0.097	-0.065	-0.032	0.008	0.047
1.6	-0.109	-0.077	-0.045	-0.007	0.034
1.7	-0.123	-0.090	-0.058	-0.023	0.020
1.8	-0.136	-0.103	-0.070	-0.036	0.007
1.9	-0.149	-0.116	-0.082	-0.048	-0.007
2.0	-0.163	-0.129	-0.095	-0.060	-0.021
2.1	-0.177	-0.143	-0.107	-0.072	-0.035
2.2	-0.191	-0.157	-0.120	-0.085	-0.048
2.3	-0.205	-0.171	-0.134	-0.097	-0.061
2.4	-0.219	-0.185	-0.148	-0.110	-0.073
2.5	-0.233	-0.199	-0.162	-0.123	-0.086
2.6	-0.248	-0.214	-0.176	-0.136	-0.099
2.7	-0.263	-0.229	-0.190	-0.150	-0.112
2.8	-0.278	-0.243	-0.205	-0.163	-0.125
2.9	-0.293	-0.258	-0.219	-0.177	-0.138
3.0	-0.309	-0.274	-0.234	-0.191	-0.151
3.1	-0.324	-0.289	-0.249	-0.205	-0.164
3.2	-0.339	-0.304	-0.264	-0.219	-0.177
3.3	-0.355	-0.320	-0.279	-0.233	-0.190
3.4	-0.371	-0.336	-0.295	-0.248	-0.203

$J \backslash \beta_{0.75}$	15	20	25	30	35
3.5	-0.389	-0.353	-0.311	-0.264	-0.217
3.6	-0.406	-0.370	-0.328	-0.279	-0.231
3.7	-0.423	-0.387	-0.344	-0.294	-0.245
3.8	-0.441	-0.404	-0.360	-0.309	-0.259
3.9	-0.458	-0.421	-0.376	-0.324	-0.273
4.0	-0.475	-0.438	-0.392	-0.340	-0.286
4.1	-0.497	-0.459	-0.412	-0.357	-0.302
4.2	-0.519	-0.479	-0.431	-0.375	-0.318
4.3	-0.541	-0.500	-0.450	-0.393	-0.334
4.4	-0.563	-0.521	-0.469	-0.410	-0.350
4.5	-0.585	-0.542	-0.489	-0.428	-0.366
4.6	-0.608	-0.562	-0.508	-0.445	-0.382
4.7	-0.630	-0.583	-0.527	-0.463	-0.398
4.8	-0.652	-0.604	-0.546	-0.481	-0.414
4.9	-0.674	-0.624	-0.566	-0.498	-0.430
5.0	-0.696	-0.645	-0.585	-0.516	-0.446

Combined thrust coefficient [2], [3]

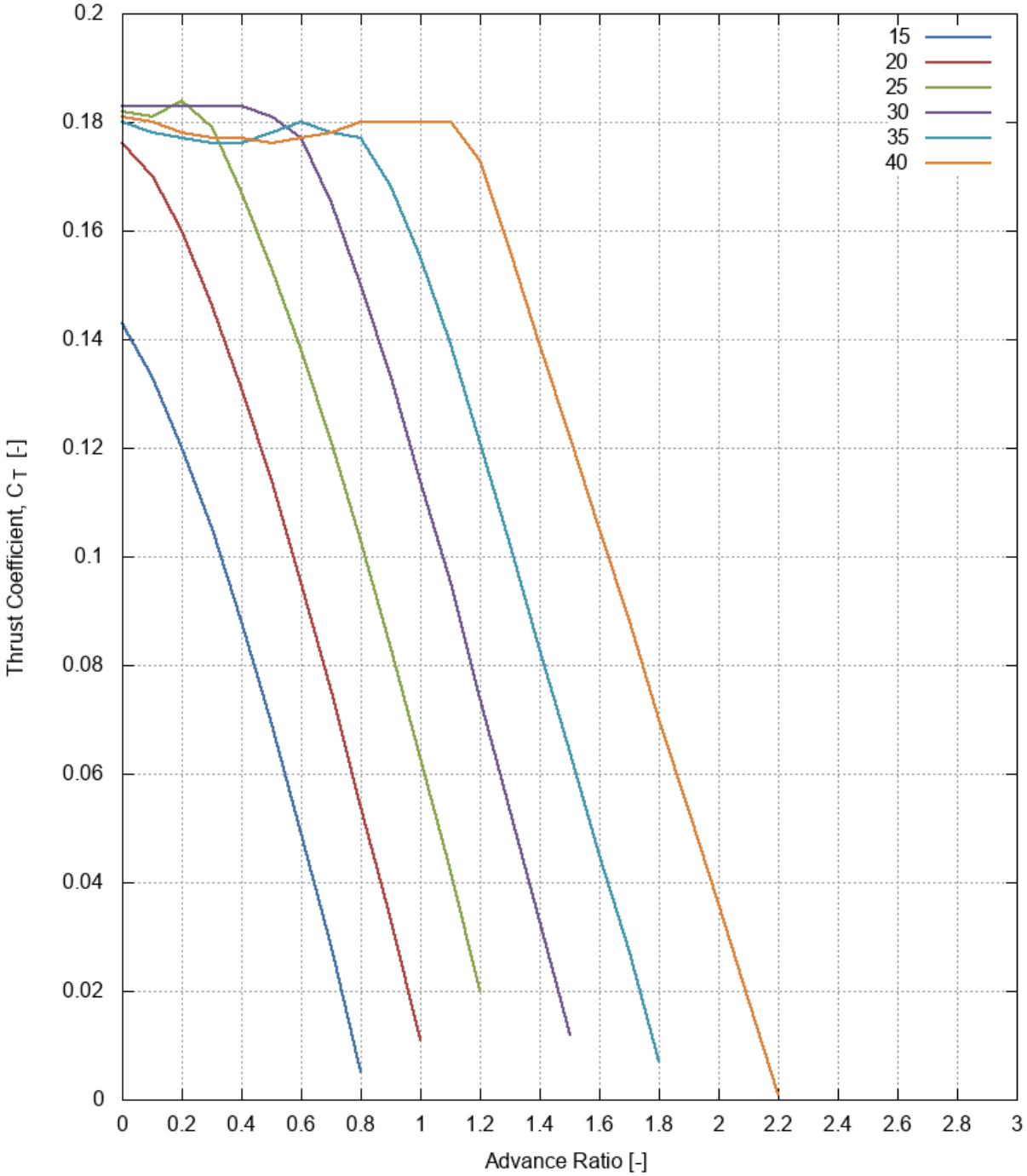
6.7. Combined Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35
0.0	0.037	0.060	0.073	0.139	0.183
0.1	0.039	0.062	0.076	0.133	0.177
0.2	0.039	0.063	0.080	0.125	0.170
0.3	0.039	0.064	0.082	0.115	0.163
0.4	0.037	0.063	0.085	0.109	0.156
0.5	0.033	0.061	0.085	0.110	0.150
0.6	0.027	0.056	0.084	0.112	0.145
0.7	0.020	0.049	0.080	0.112	0.142
0.8	0.011	0.041	0.073	0.109	0.144
0.9	0.000	0.030	0.064	0.104	0.147
1.0	-0.007	0.018	0.053	0.096	0.144
1.1	-0.016	0.006	0.041	0.085	0.137
1.2	-0.025	-0.010	0.027	0.072	0.127
1.3	-0.032	-0.021	0.012	0.058	0.115
1.4	-0.041	-0.031	-0.005	0.042	0.102
1.5	-0.049	-0.041	-0.021	0.025	0.087
1.6	-0.058	-0.051	-0.034	0.007	0.070
1.7	-0.067	-0.061	-0.046	-0.013	0.051
1.8	-0.077	-0.072	-0.059	-0.030	0.031
1.9	-0.086	-0.083	-0.072	-0.045	0.009
2.0	-0.096	-0.094	-0.085	-0.059	-0.012
2.1	-0.105	-0.105	-0.098	-0.073	-0.033
2.2	-0.115	-0.117	-0.111	-0.088	-0.051
2.3	-0.124	-0.128	-0.124	-0.102	-0.067
2.4	-0.134	-0.139	-0.138	-0.116	-0.082
2.5	-0.144	-0.150	-0.151	-0.131	-0.098
2.6	-0.154	-0.161	-0.165	-0.146	-0.114
2.7	-0.163	-0.173	-0.178	-0.162	-0.130
2.8	-0.173	-0.185	-0.192	-0.177	-0.146
2.9	-0.183	-0.197	-0.206	-0.194	-0.163
3.0	-0.193	-0.209	-0.220	-0.211	-0.181
3.1	-0.203	-0.222	-0.235	-0.228	-0.199
3.2	-0.213	-0.235	-0.249	-0.246	-0.216
3.3	-0.222	-0.247	-0.264	-0.263	-0.234
3.4	-0.233	-0.261	-0.280	-0.282	-0.254

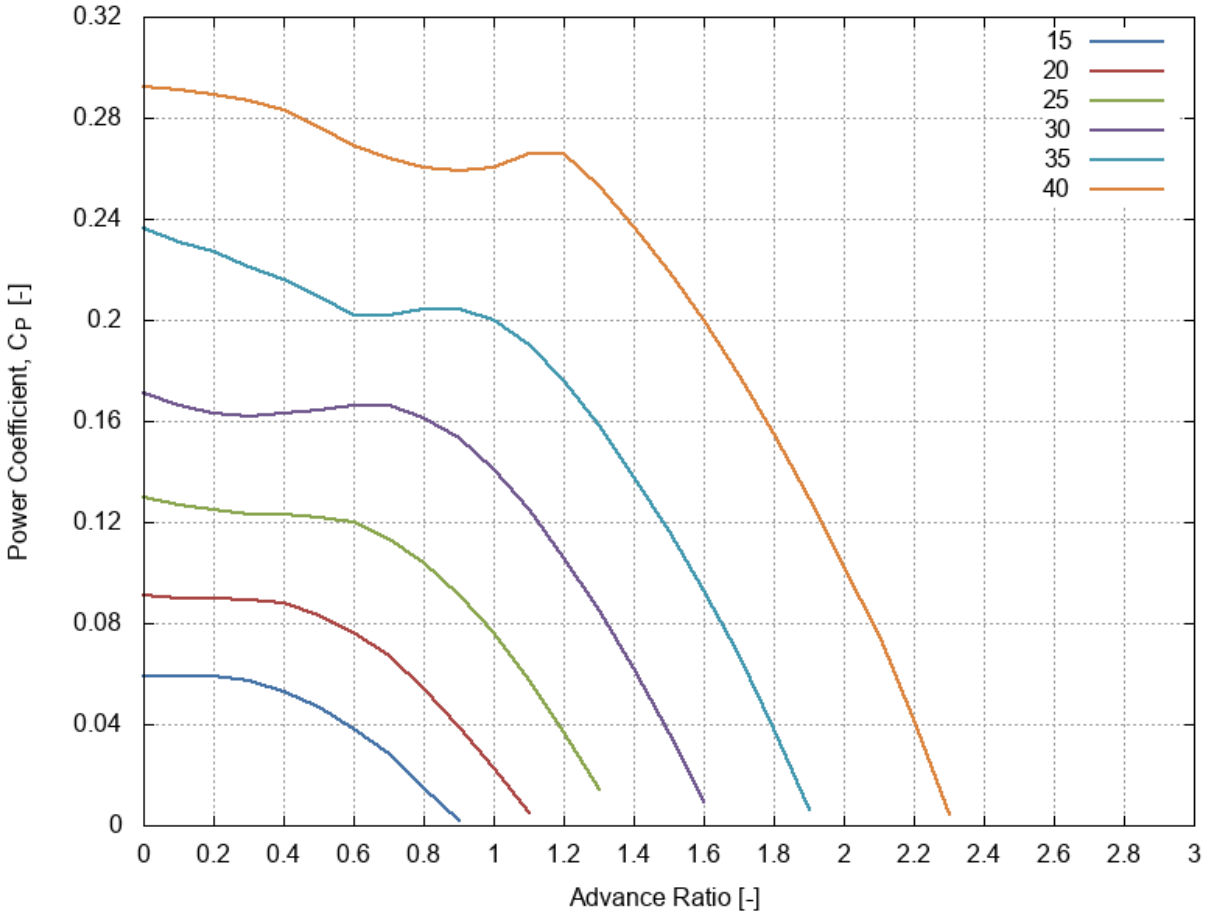
$J \backslash \beta_{0.75}$	15	20	25	30	35
3.5	-0.245	-0.276	-0.297	-0.302	-0.274
3.6	-0.256	-0.291	-0.314	-0.322	-0.295
3.7	-0.267	-0.306	-0.331	-0.341	-0.315
3.8	-0.279	-0.320	-0.348	-0.361	-0.336
3.9	-0.290	-0.335	-0.365	-0.381	-0.356
4.0	-0.301	-0.350	-0.382	-0.401	-0.377
4.1	-0.316	-0.368	-0.403	-0.423	-0.401
4.2	-0.331	-0.386	-0.424	-0.445	-0.426
4.3	-0.346	-0.404	-0.446	-0.468	-0.451
4.4	-0.360	-0.422	-0.467	-0.490	-0.475
4.5	-0.375	-0.441	-0.488	-0.513	-0.500
4.6	-0.390	-0.459	-0.509	-0.535	-0.524
4.7	-0.405	-0.477	-0.530	-0.558	-0.549
4.8	-0.419	-0.495	-0.552	-0.580	-0.574
4.9	-0.434	-0.513	-0.573	-0.602	-0.598
5.0	-0.449	-0.531	-0.594	-0.625	-0.623

Combined power coefficient [2], [3]

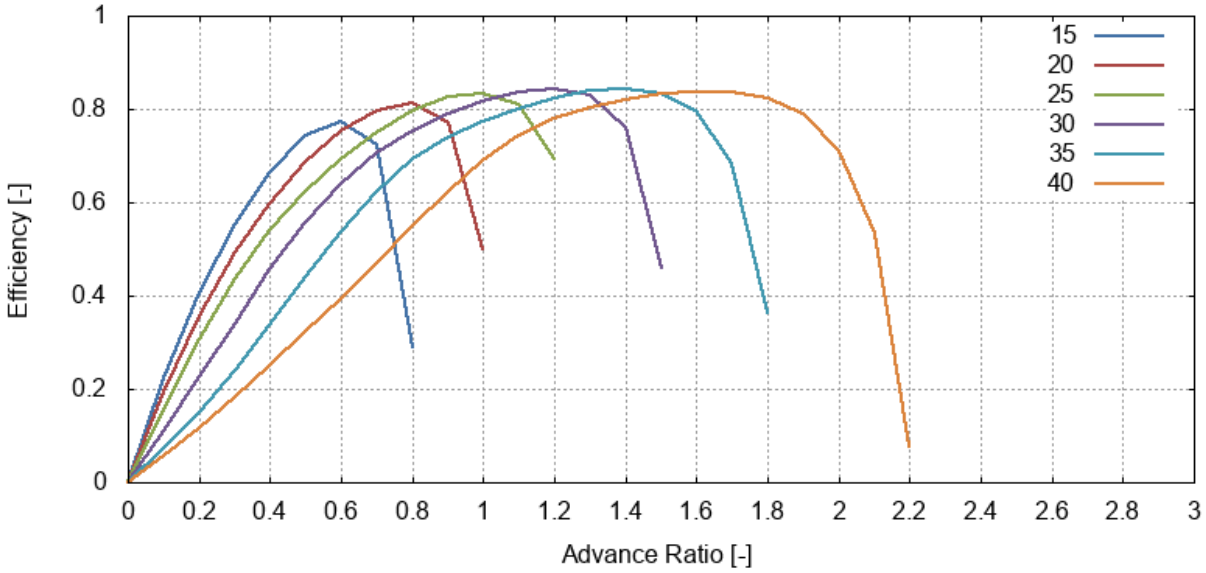
7. US Navy Bureau of Aeronautics propeller 5868-R6, 3 blades



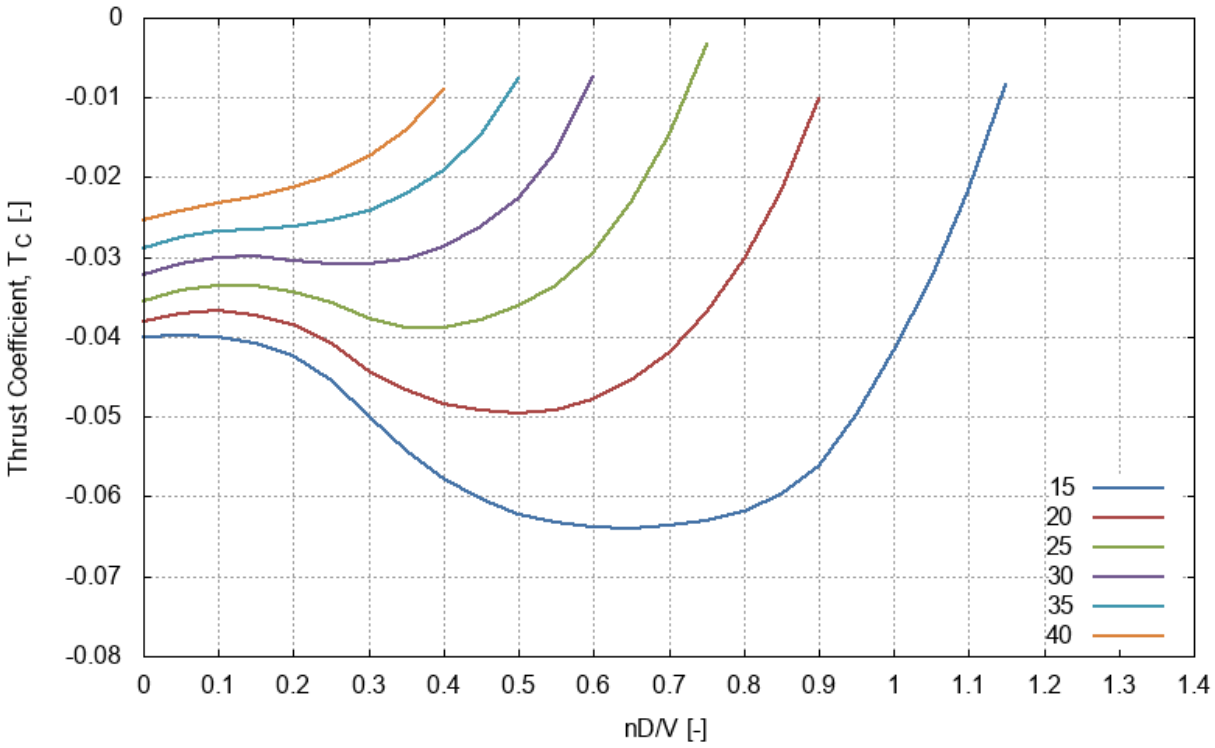
Thrust coefficient [2]



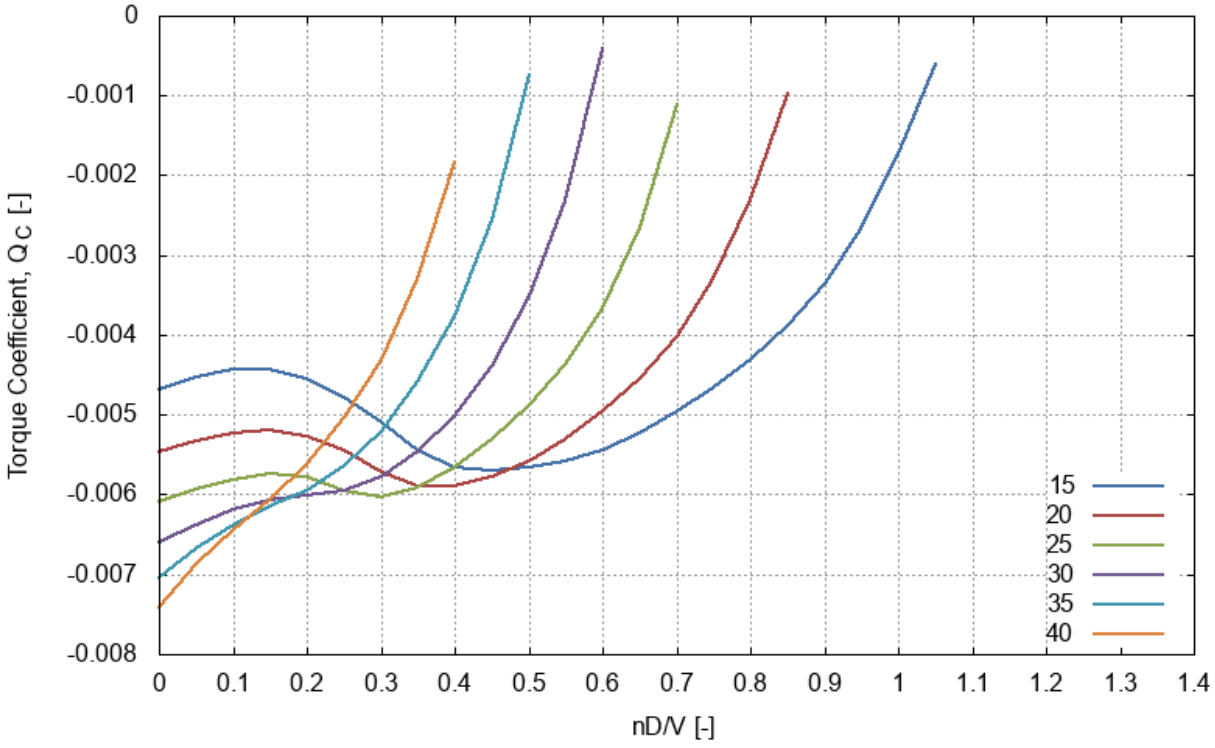
Power coefficient [2]



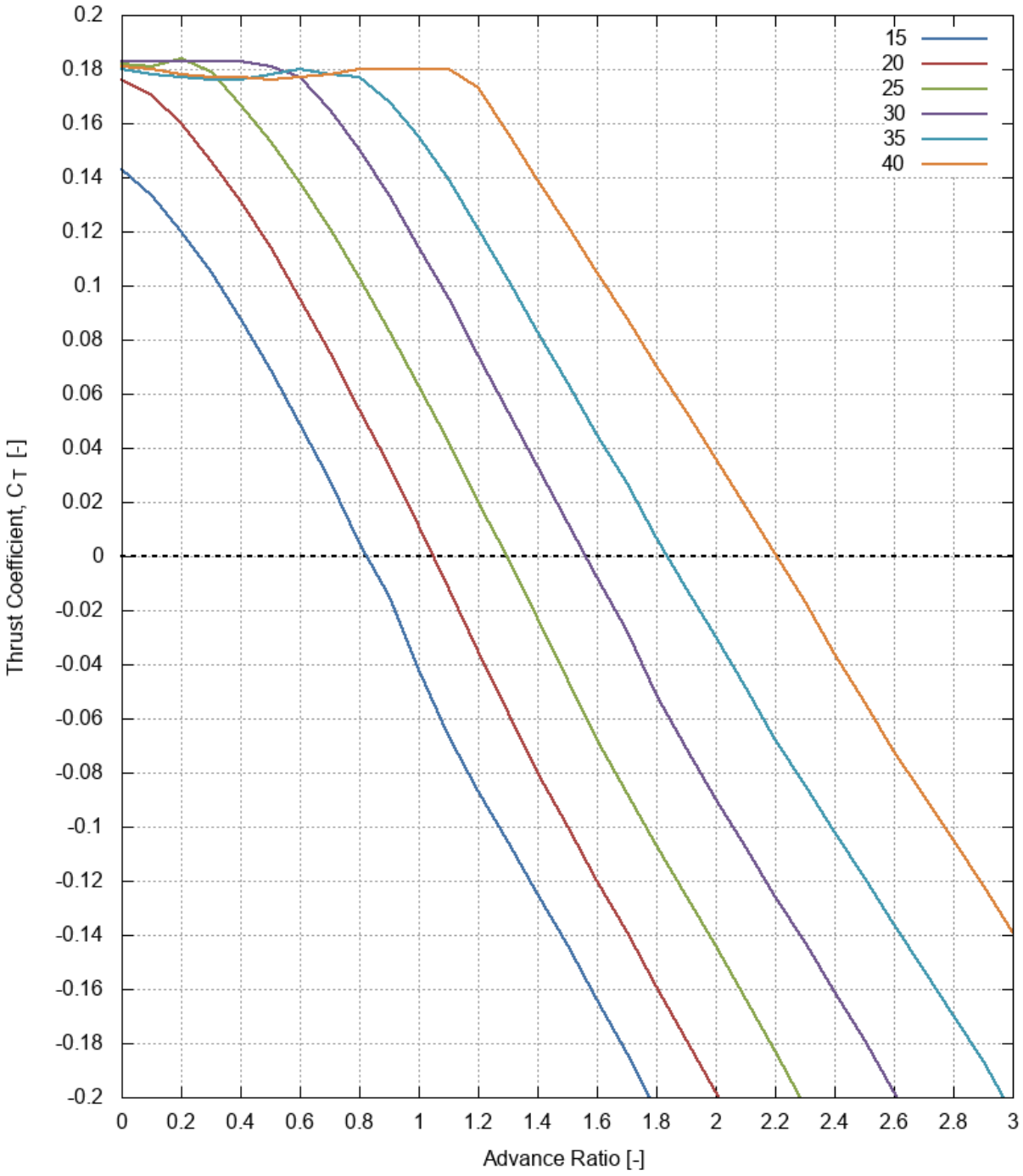
Efficiency [2]



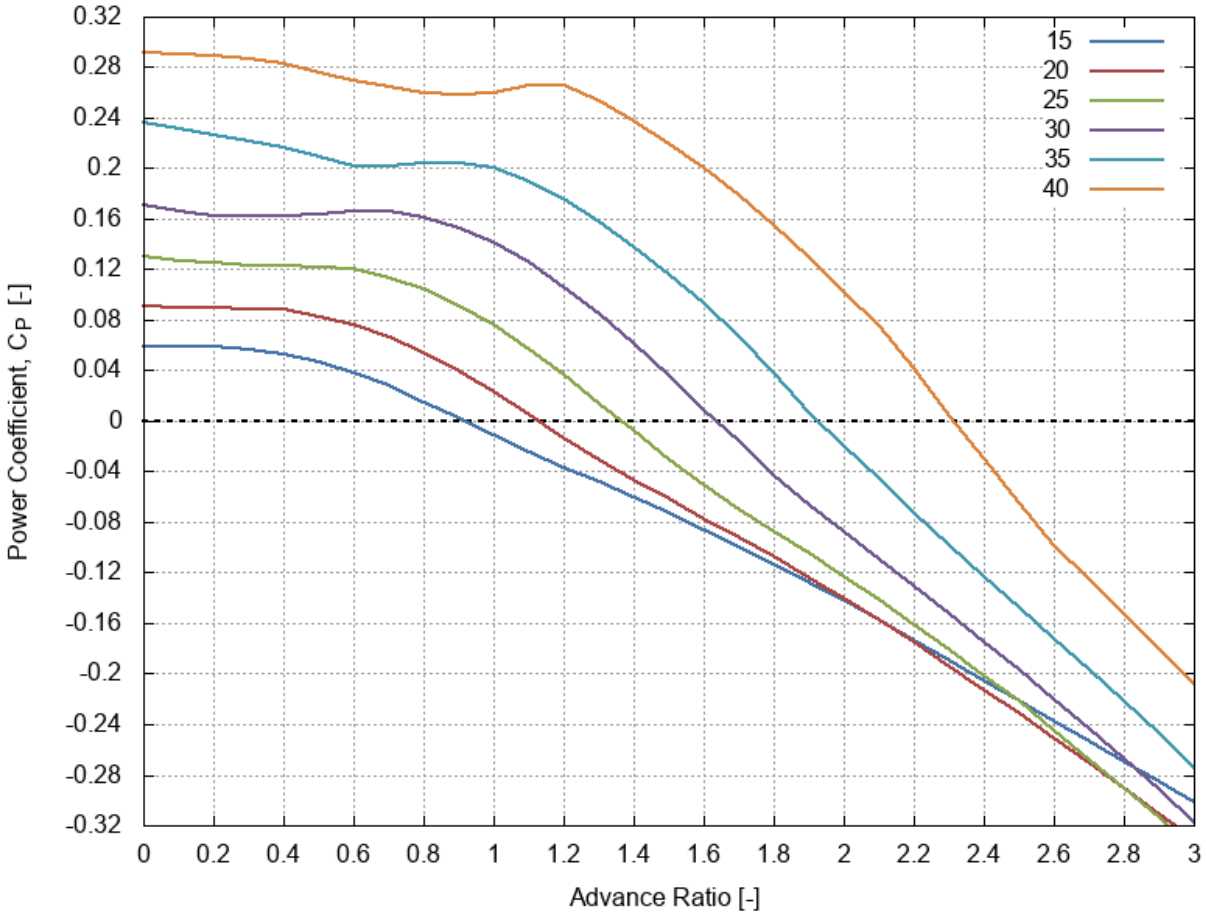
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [2], [3]



Combined power coefficient [2], [3]

7.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35	40
0.0	0.143	0.176	0.182	0.183	0.180	0.181
0.1	0.133	0.170	0.181	0.183	0.178	0.180
0.2	0.120	0.160	0.184	0.183	0.177	0.178
0.3	0.105	0.146	0.179	0.183	0.176	0.177
0.4	0.088	0.131	0.167	0.183	0.176	0.177
0.5	0.069	0.114	0.153	0.181	0.178	0.176
0.6	0.049	0.095	0.138	0.177	0.180	0.177
0.7	0.028	0.075	0.121	0.165	0.178	0.178
0.8	0.005	0.054	0.103	0.150	0.177	0.180
0.9		0.033	0.083	0.133	0.168	0.180
1.0		0.011	0.063	0.114	0.155	0.180
1.1			0.042	0.095	0.139	0.180
1.2			0.020	0.074	0.121	0.173
1.3				0.053	0.102	0.156
1.4				0.033	0.083	0.139
1.5				0.012	0.064	0.122
1.6					0.045	0.105
1.7					0.027	0.088
1.8					0.007	0.070
1.9						0.053
2.0						0.036
2.1						0.018
2.2						0.001

Thrust coefficient [2]

7.2. Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40
0.0	0.059	0.091	0.130	0.171	0.236	0.292
0.1	0.059	0.090	0.127	0.166	0.231	0.291
0.2	0.059	0.090	0.125	0.163	0.227	0.289
0.3	0.057	0.089	0.123	0.162	0.221	0.287
0.4	0.053	0.088	0.123	0.163	0.216	0.283
0.5	0.047	0.083	0.122	0.164	0.209	0.276
0.6	0.038	0.076	0.120	0.166	0.202	0.269
0.7	0.028	0.067	0.113	0.166	0.202	0.264
0.8	0.015	0.054	0.104	0.161	0.204	0.260
0.9	0.002	0.039	0.091	0.153	0.204	0.259
1.0		0.023	0.076	0.141	0.200	0.260
1.1		0.005	0.057	0.125	0.190	0.266
1.2			0.037	0.106	0.176	0.266
1.3			0.014	0.085	0.158	0.253
1.4				0.062	0.138	0.237
1.5				0.036	0.116	0.219
1.6				0.009	0.093	0.200
1.7					0.067	0.178
1.8					0.038	0.155
1.9					0.006	0.129
2.0						0.102
2.1						0.075
2.2						0.042
2.3						0.004

Power coefficient [2]

7.3. Efficiency, η

J\β$_{0.75}$	15	20	25	30	35	40
0.0	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.223	0.192	0.157	0.111	0.073	0.058
0.2	0.406	0.358	0.305	0.225	0.151	0.118
0.3	0.553	0.493	0.435	0.340	0.241	0.183
0.4	0.662	0.597	0.541	0.455	0.335	0.251
0.5	0.744	0.685	0.624	0.556	0.439	0.322
0.6	0.774	0.752	0.694	0.641	0.535	0.394
0.7	0.724	0.796	0.750	0.707	0.622	0.471
0.8	0.291	0.813	0.796	0.754	0.694	0.551
0.9		0.769	0.826	0.790	0.741	0.624
1.0		0.499	0.834	0.818	0.774	0.691
1.1			0.811	0.836	0.800	0.743
1.2			0.693	0.842	0.824	0.780
1.3				0.830	0.839	0.803
1.4				0.760	0.844	0.821
1.5				0.461	0.834	0.832
1.6					0.796	0.838
1.7					0.684	0.836
1.8					0.362	0.822
1.9						0.789
2.0						0.710
2.1						0.534
2.2						0.078

Efficiency [2]

7.4. Negative Thrust Coefficient, T_C

$nD/V\backslash\beta_{0.75}$	15	20	25	30	35	40
0.00	-0.040	-0.038	-0.035	-0.032	-0.029	-0.025
0.05	-0.040	-0.037	-0.034	-0.031	-0.028	-0.024
0.10	-0.040	-0.037	-0.034	-0.030	-0.027	-0.023
0.15	-0.041	-0.037	-0.034	-0.030	-0.027	-0.022
0.20	-0.042	-0.038	-0.034	-0.030	-0.026	-0.021
0.25	-0.045	-0.041	-0.036	-0.031	-0.025	-0.020
0.30	-0.050	-0.044	-0.038	-0.031	-0.024	-0.017
0.35	-0.054	-0.047	-0.039	-0.030	-0.022	-0.014
0.40	-0.058	-0.048	-0.039	-0.029	-0.019	-0.009
0.45	-0.060	-0.049	-0.038	-0.026	-0.015	
0.50	-0.062	-0.050	-0.036	-0.023	-0.008	
0.55	-0.063	-0.049	-0.034	-0.017		
0.60	-0.064	-0.048	-0.029	-0.007		
0.65	-0.064	-0.045	-0.023			
0.70	-0.064	-0.042	-0.015			
0.75	-0.063	-0.037	-0.003			
0.80	-0.062	-0.030				
0.85	-0.060	-0.022				
0.90	-0.056	-0.010				
0.95	-0.050					
1.00	-0.042					
1.05	-0.033					
1.10	-0.022					
1.15	-0.008					

Negative thrust coefficient [3]

7.5. Negative Torque Coefficient, Q_C

nD/V\β0.75	15	20	25	30	35	40
0.00	-0.0047	-0.0055	-0.0061	-0.0066	-0.0070	-0.0074
0.05	-0.0045	-0.0053	-0.0059	-0.0064	-0.0067	-0.0069
0.10	-0.0044	-0.0052	-0.0058	-0.0062	-0.0064	-0.0064
0.15	-0.0044	-0.0052	-0.0057	-0.0061	-0.0062	-0.0061
0.20	-0.0046	-0.0053	-0.0058	-0.0060	-0.0059	-0.0056
0.25	-0.0048	-0.0055	-0.0060	-0.0059	-0.0056	-0.0050
0.30	-0.0051	-0.0057	-0.0060	-0.0058	-0.0052	-0.0043
0.35	-0.0055	-0.0059	-0.0059	-0.0055	-0.0046	-0.0033
0.40	-0.0057	-0.0059	-0.0057	-0.0050	-0.0038	-0.0018
0.45	-0.0057	-0.0058	-0.0053	-0.0044	-0.0026	
0.50	-0.0057	-0.0056	-0.0049	-0.0035	-0.0007	
0.55	-0.0056	-0.0053	-0.0044	-0.0023		
0.60	-0.0054	-0.0050	-0.0037	-0.0004		
0.65	-0.0052	-0.0045	-0.0026			
0.70	-0.0050	-0.0040	-0.0011			
0.75	-0.0047	-0.0033				
0.80	-0.0043	-0.0023				
0.85	-0.0039	-0.0010				
0.90	-0.0034					
0.95	-0.0027					
1.00	-0.0017					
1.05	-0.0006					

Negative torque coefficient [3]

7.6. Combined Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35	40
0.0	0.143	0.176	0.182	0.183	0.180	0.181
0.1	0.133	0.170	0.181	0.183	0.178	0.180
0.2	0.120	0.160	0.184	0.183	0.177	0.178
0.3	0.105	0.146	0.179	0.183	0.176	0.177
0.4	0.088	0.131	0.167	0.183	0.176	0.177
0.5	0.069	0.114	0.153	0.181	0.178	0.176
0.6	0.049	0.095	0.138	0.177	0.180	0.177
0.7	0.028	0.075	0.121	0.165	0.178	0.178
0.8	0.005	0.054	0.103	0.150	0.177	0.180
0.9	-0.015	0.033	0.083	0.133	0.168	0.180
1.0	-0.042	0.011	0.063	0.114	0.155	0.180
1.1	-0.067	-0.012	0.042	0.095	0.139	0.180
1.2	-0.087	-0.035	0.020	0.074	0.121	0.173
1.3	-0.106	-0.058	-0.001	0.053	0.102	0.156
1.4	-0.125	-0.080	-0.023	0.033	0.083	0.139
1.5	-0.144	-0.100	-0.046	0.012	0.064	0.122
1.6	-0.164	-0.120	-0.068	-0.008	0.045	0.105
1.7	-0.184	-0.139	-0.088	-0.028	0.027	0.088
1.8	-0.205	-0.159	-0.107	-0.051	0.007	0.070
1.9	-0.227	-0.179	-0.126	-0.071	-0.012	0.053
2.0	-0.249	-0.198	-0.144	-0.090	-0.030	0.036
2.1	-0.271	-0.219	-0.164	-0.108	-0.049	0.018
2.2	-0.293	-0.239	-0.183	-0.126	-0.068	0.001
2.3	-0.316	-0.260	-0.203	-0.143	-0.085	-0.017
2.4	-0.338	-0.281	-0.223	-0.161	-0.102	-0.036
2.5	-0.361	-0.302	-0.243	-0.179	-0.119	-0.054
2.6	-0.384	-0.324	-0.264	-0.198	-0.136	-0.072
2.7	-0.407	-0.346	-0.285	-0.217	-0.153	-0.089
2.8	-0.429	-0.368	-0.306	-0.236	-0.170	-0.105
2.9	-0.453	-0.391	-0.327	-0.255	-0.187	-0.122
3.0	-0.476	-0.414	-0.348	-0.275	-0.206	-0.139
3.1	-0.500	-0.438	-0.369	-0.295	-0.224	-0.155
3.2	-0.524	-0.461	-0.390	-0.316	-0.243	-0.172
3.3	-0.547	-0.484	-0.410	-0.336	-0.262	-0.188
3.4	-0.572	-0.508	-0.433	-0.358	-0.282	-0.206

$J \backslash \beta_{0.75}$	15	20	25	30	35	40
3.5	-0.598	-0.532	-0.456	-0.381	-0.302	-0.224
3.6	-0.624	-0.557	-0.479	-0.403	-0.323	-0.243
3.7	-0.649	-0.581	-0.503	-0.426	-0.344	-0.261
3.8	-0.675	-0.605	-0.526	-0.449	-0.364	-0.279
3.9	-0.701	-0.629	-0.549	-0.472	-0.385	-0.297
4.0	-0.726	-0.653	-0.572	-0.495	-0.406	-0.315
4.1	-0.760	-0.684	-0.601	-0.521	-0.431	-0.337
4.2	-0.793	-0.715	-0.630	-0.548	-0.455	-0.359
4.3	-0.826	-0.746	-0.659	-0.574	-0.480	-0.381
4.4	-0.860	-0.776	-0.687	-0.601	-0.505	-0.403
4.5	-0.893	-0.807	-0.716	-0.627	-0.530	-0.424
4.6	-0.927	-0.838	-0.745	-0.654	-0.555	-0.446
4.7	-0.960	-0.868	-0.774	-0.680	-0.580	-0.468
4.8	-0.993	-0.899	-0.802	-0.707	-0.605	-0.490
4.9	-1.027	-0.930	-0.831	-0.733	-0.629	-0.512
5.0	-1.060	-0.960	-0.860	-0.760	-0.654	-0.534

Combined thrust coefficient [2], [3]

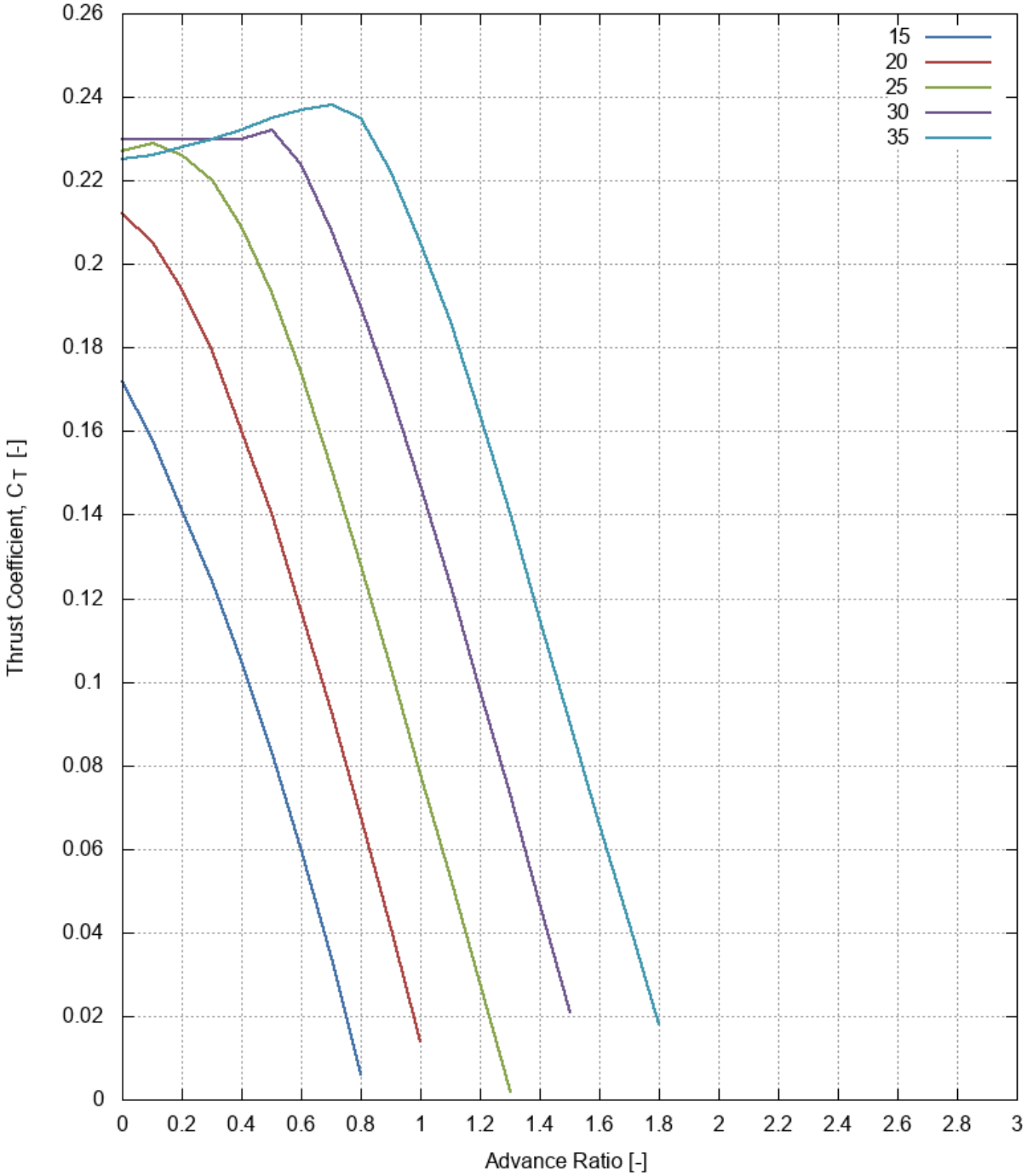
7.7. Combined Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35	40
0.0	0.059	0.091	0.130	0.171	0.236	0.292
0.1	0.059	0.090	0.127	0.166	0.231	0.291
0.2	0.059	0.090	0.125	0.163	0.227	0.289
0.3	0.057	0.089	0.123	0.162	0.221	0.287
0.4	0.053	0.088	0.123	0.163	0.216	0.283
0.5	0.047	0.083	0.122	0.164	0.209	0.276
0.6	0.038	0.076	0.120	0.166	0.202	0.269
0.7	0.028	0.067	0.113	0.166	0.202	0.264
0.8	0.015	0.054	0.104	0.161	0.204	0.260
0.9	0.002	0.039	0.091	0.153	0.204	0.259
1.0	-0.011	0.023	0.076	0.141	0.200	0.260
1.1	-0.025	0.005	0.057	0.125	0.190	0.266
1.2	-0.037	-0.013	0.037	0.106	0.176	0.266
1.3	-0.048	-0.031	0.014	0.085	0.158	0.253
1.4	-0.060	-0.047	-0.008	0.062	0.138	0.237
1.5	-0.073	-0.062	-0.031	0.036	0.116	0.219
1.6	-0.086	-0.077	-0.051	0.009	0.093	0.200
1.7	-0.100	-0.092	-0.070	-0.016	0.067	0.178
1.8	-0.113	-0.107	-0.088	-0.043	0.038	0.155
1.9	-0.128	-0.124	-0.105	-0.066	0.006	0.129
2.0	-0.142	-0.140	-0.123	-0.088	-0.020	0.102
2.1	-0.158	-0.158	-0.142	-0.110	-0.046	0.075
2.2	-0.174	-0.175	-0.161	-0.131	-0.073	0.042
2.3	-0.190	-0.194	-0.181	-0.153	-0.098	0.004
2.4	-0.206	-0.213	-0.202	-0.175	-0.123	-0.030
2.5	-0.222	-0.232	-0.222	-0.197	-0.148	-0.065
2.6	-0.238	-0.251	-0.245	-0.220	-0.172	-0.099
2.7	-0.254	-0.271	-0.268	-0.244	-0.197	-0.126
2.8	-0.270	-0.291	-0.290	-0.267	-0.222	-0.153
2.9	-0.286	-0.311	-0.314	-0.292	-0.247	-0.181
3.0	-0.302	-0.331	-0.338	-0.317	-0.274	-0.208
3.1	-0.318	-0.352	-0.363	-0.343	-0.301	-0.236
3.2	-0.334	-0.372	-0.388	-0.369	-0.328	-0.264
3.3	-0.350	-0.392	-0.413	-0.395	-0.354	-0.292
3.4	-0.368	-0.414	-0.439	-0.423	-0.384	-0.321

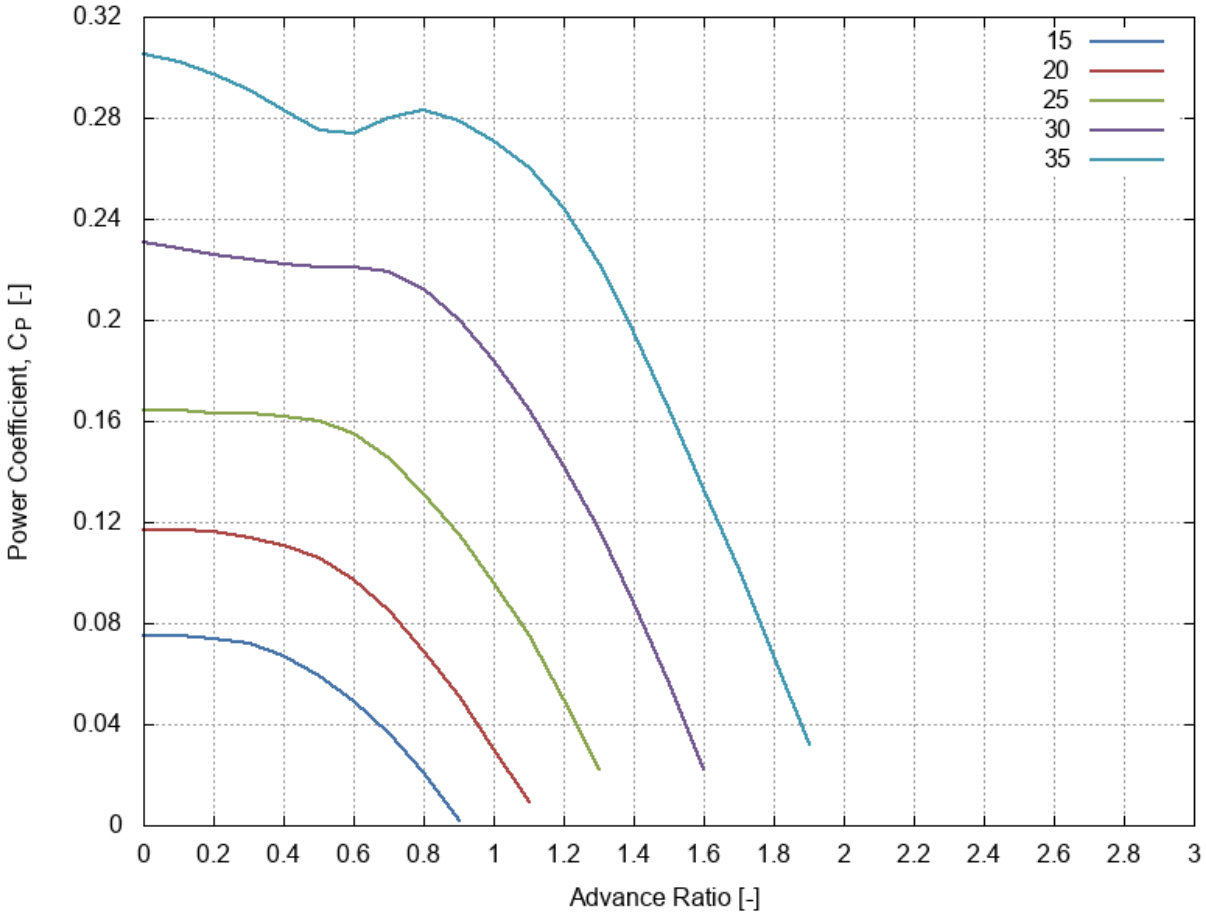
J\β0.75	15	20	25	30	35	40
3.5	-0.387	-0.436	-0.465	-0.452	-0.414	-0.352
3.6	-0.405	-0.459	-0.492	-0.481	-0.445	-0.383
3.7	-0.424	-0.481	-0.518	-0.510	-0.476	-0.414
3.8	-0.443	-0.503	-0.545	-0.539	-0.506	-0.445
3.9	-0.461	-0.526	-0.572	-0.569	-0.537	-0.476
4.0	-0.480	-0.548	-0.598	-0.598	-0.568	-0.506
4.1	-0.503	-0.576	-0.629	-0.632	-0.604	-0.544
4.2	-0.527	-0.604	-0.660	-0.667	-0.641	-0.582
4.3	-0.550	-0.632	-0.691	-0.702	-0.677	-0.619
4.4	-0.574	-0.659	-0.722	-0.737	-0.714	-0.657
4.5	-0.598	-0.687	-0.753	-0.771	-0.751	-0.694
4.6	-0.621	-0.715	-0.783	-0.806	-0.787	-0.732
4.7	-0.645	-0.743	-0.814	-0.841	-0.824	-0.769
4.8	-0.668	-0.771	-0.845	-0.875	-0.861	-0.807
4.9	-0.692	-0.799	-0.876	-0.910	-0.897	-0.845
5.0	-0.715	-0.827	-0.907	-0.945	-0.934	-0.882

Combined power coefficient [2], [3]

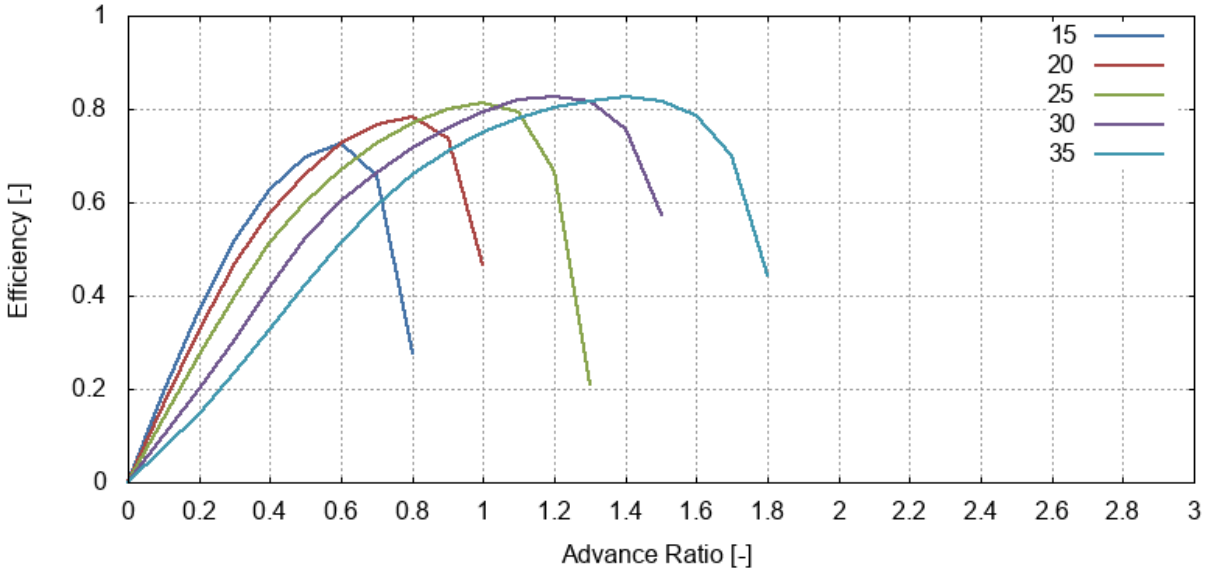
8. US Navy Bureau of Aeronautics propeller 5868-R6, 4 blades



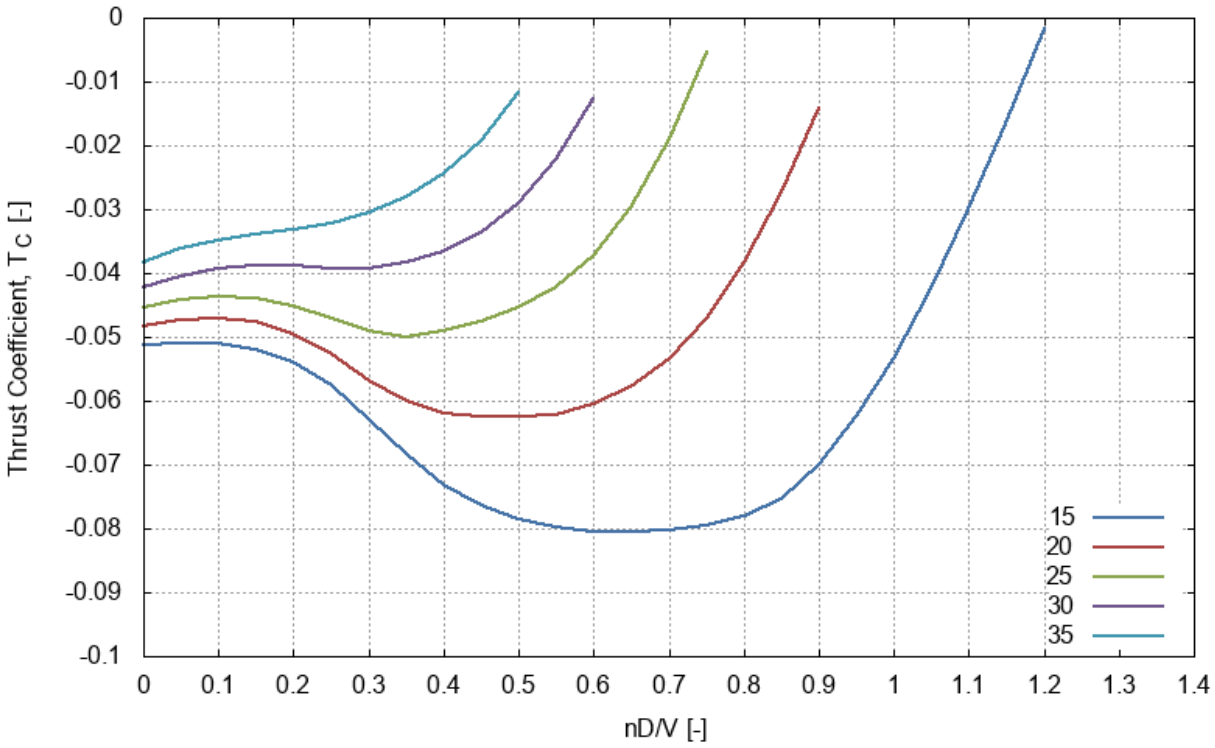
Thrust coefficient [2]



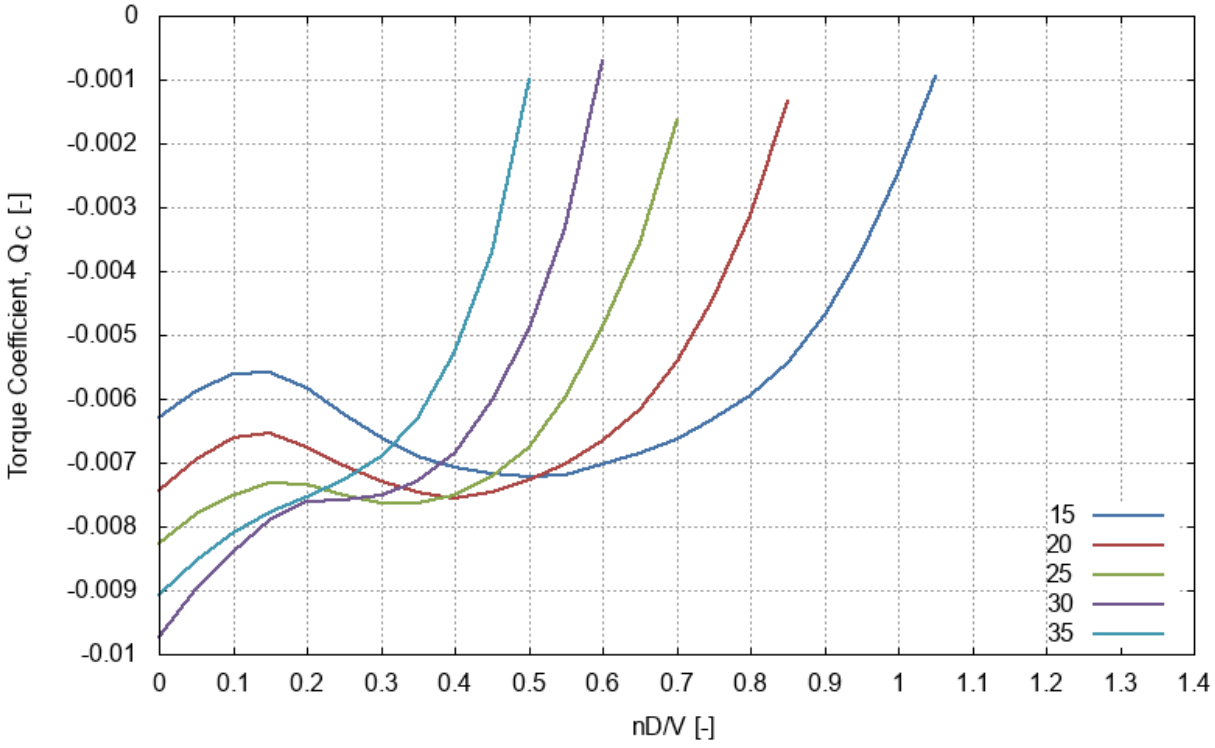
Power coefficient [2]



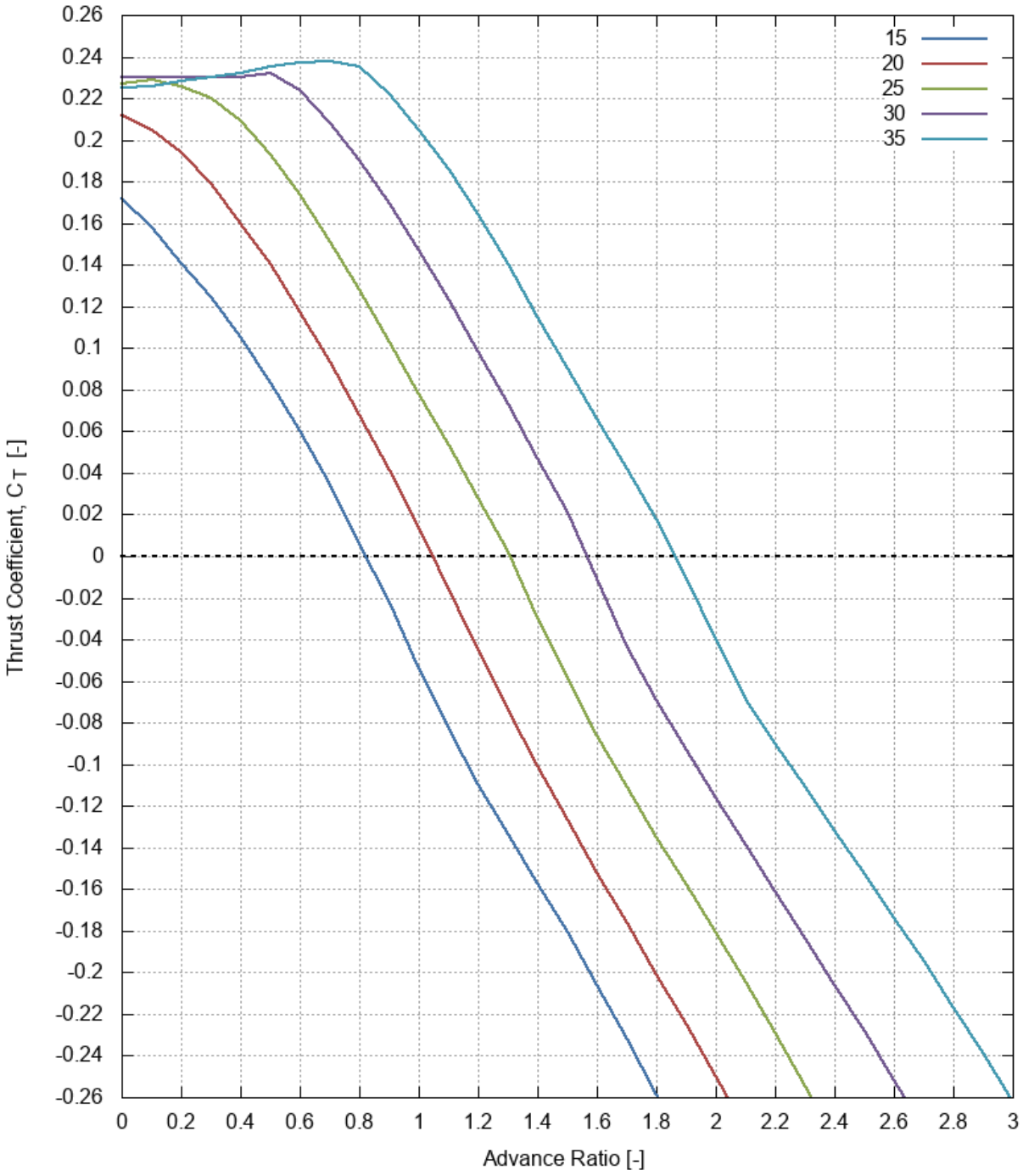
Efficiency [2]



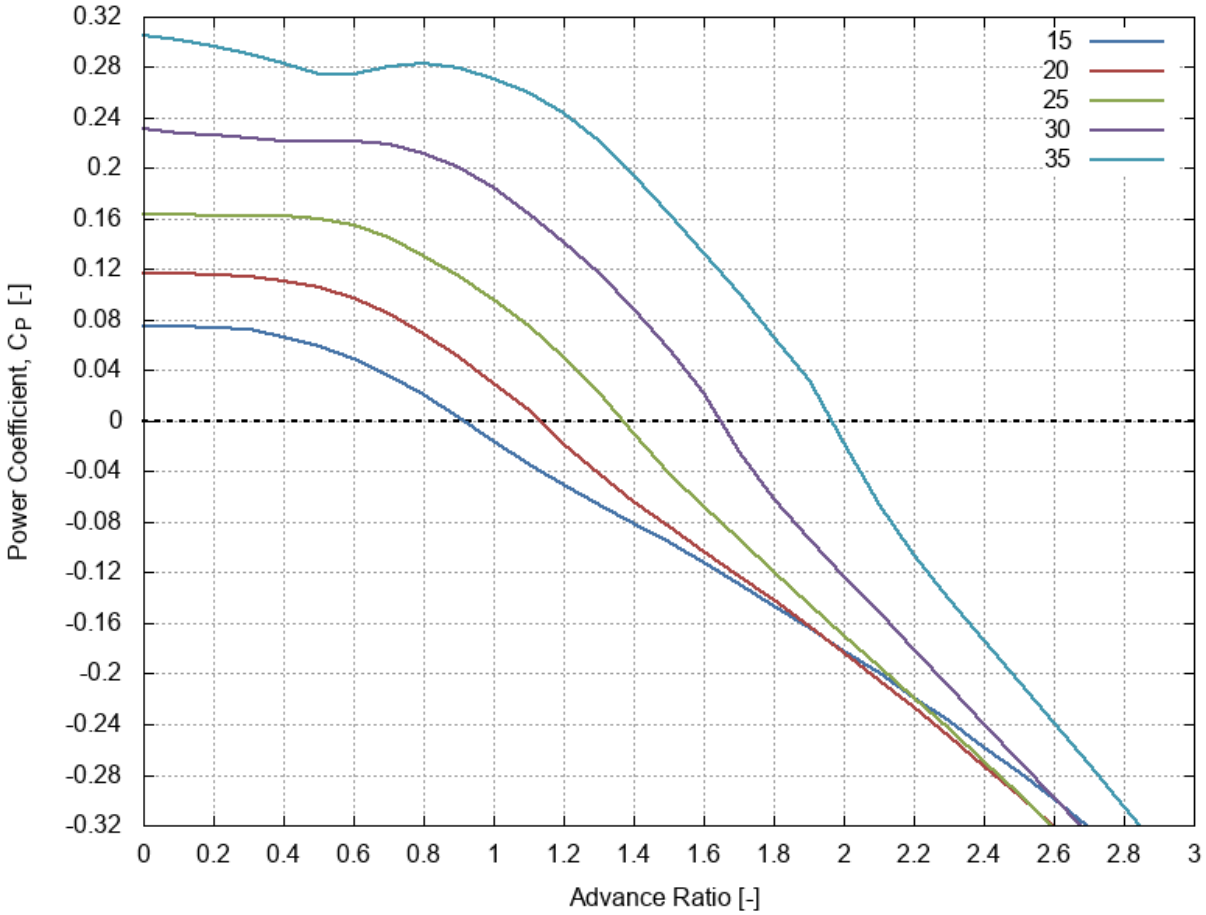
Negative thrust coefficient [3]



Negative torque coefficient [3]



Combined thrust coefficient [2], [3]



Combined power coefficient [2], [3]

8.1. Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35
0.0	0.172	0.212	0.227	0.230	0.225
0.1	0.158	0.205	0.229	0.230	0.226
0.2	0.141	0.194	0.226	0.230	0.228
0.3	0.124	0.179	0.220	0.230	0.230
0.4	0.105	0.160	0.209	0.230	0.232
0.5	0.083	0.140	0.193	0.232	0.235
0.6	0.060	0.117	0.174	0.224	0.237
0.7	0.034	0.093	0.151	0.208	0.238
0.8	0.006	0.068	0.128	0.190	0.235
0.9		0.041	0.103	0.169	0.222
1.0		0.014	0.078	0.147	0.205
1.1			0.053	0.123	0.186
1.2			0.028	0.098	0.164
1.3			0.002	0.073	0.140
1.4				0.047	0.115
1.5				0.021	0.090
1.6					0.066
1.7					0.042
1.8					0.018

Thrust coefficient [2]

8.2. Power Coefficient, C_P

$J \backslash \beta_{0.75}$	15	20	25	30	35
0.0	0.075	0.117	0.164	0.231	0.305
0.1	0.075	0.117	0.164	0.228	0.302
0.2	0.074	0.116	0.163	0.226	0.297
0.3	0.072	0.114	0.163	0.224	0.291
0.4	0.067	0.111	0.162	0.222	0.283
0.5	0.059	0.106	0.160	0.221	0.275
0.6	0.049	0.097	0.155	0.221	0.274
0.7	0.036	0.085	0.145	0.219	0.280
0.8	0.021	0.069	0.131	0.212	0.283
0.9	0.002	0.051	0.115	0.200	0.279
1.0		0.030	0.096	0.184	0.271
1.1		0.009	0.075	0.164	0.260
1.2			0.050	0.142	0.244
1.3			0.022	0.117	0.222
1.4				0.088	0.195
1.5				0.056	0.164
1.6				0.022	0.133
1.7					0.101
1.8					0.067
1.9					0.032

Power coefficient [2]

8.3. Efficiency, η

J\β$_{0.75}$	15	20	25	30	35
0.0	0.000	0.000	0.000	0.000	0.000
0.1	0.192	0.168	0.136	0.100	0.074
0.2	0.369	0.328	0.272	0.201	0.148
0.3	0.519	0.469	0.400	0.306	0.235
0.4	0.627	0.577	0.513	0.415	0.326
0.5	0.697	0.661	0.601	0.524	0.424
0.6	0.728	0.725	0.671	0.603	0.513
0.7	0.656	0.767	0.727	0.663	0.593
0.8	0.275	0.783	0.769	0.716	0.659
0.9		0.736	0.800	0.759	0.709
1.0		0.468	0.813	0.794	0.749
1.1			0.792	0.819	0.779
1.2			0.668	0.826	0.802
1.3			0.209	0.815	0.817
1.4				0.756	0.825
1.5				0.572	0.816
1.6					0.786
1.7					0.699
1.8					0.444

Efficiency [2]

8.4. Negative Thrust Coefficient, T_C

$nD/V\backslash\beta_{0.75}$	15	20	25	30	35
0.00	-0.051	-0.048	-0.045	-0.042	-0.038
0.05	-0.051	-0.047	-0.044	-0.041	-0.036
0.10	-0.051	-0.047	-0.044	-0.039	-0.035
0.15	-0.052	-0.048	-0.044	-0.039	-0.034
0.20	-0.054	-0.050	-0.045	-0.039	-0.033
0.25	-0.058	-0.053	-0.047	-0.039	-0.032
0.30	-0.063	-0.057	-0.049	-0.039	-0.031
0.35	-0.068	-0.060	-0.050	-0.038	-0.028
0.40	-0.073	-0.062	-0.049	-0.037	-0.024
0.45	-0.076	-0.062	-0.047	-0.034	-0.019
0.50	-0.079	-0.063	-0.045	-0.029	-0.012
0.55	-0.080	-0.062	-0.042	-0.022	
0.60	-0.080	-0.061	-0.037	-0.013	
0.65	-0.081	-0.058	-0.030		
0.70	-0.080	-0.053	-0.019		
0.75	-0.079	-0.047	-0.005		
0.80	-0.078	-0.038			
0.85	-0.075	-0.027			
0.90	-0.070	-0.014			
0.95	-0.062				
1.00	-0.054				
1.05	-0.042				
1.10	-0.030				
1.15	-0.016				
1.20	-0.002				

Negative thrust coefficient [3]

8.5. Negative Torque Coefficient, Q_C

nD/V\β$_{0.75}$	15	20	25	30	35
0.00	-0.0063	-0.0074	-0.0083	-0.0097	-0.0091
0.05	-0.0059	-0.0069	-0.0078	-0.0090	-0.0085
0.10	-0.0056	-0.0066	-0.0075	-0.0084	-0.0081
0.15	-0.0056	-0.0065	-0.0073	-0.0079	-0.0078
0.20	-0.0058	-0.0068	-0.0073	-0.0076	-0.0075
0.25	-0.0062	-0.0071	-0.0075	-0.0076	-0.0073
0.30	-0.0066	-0.0073	-0.0076	-0.0075	-0.0069
0.35	-0.0069	-0.0075	-0.0076	-0.0073	-0.0063
0.40	-0.0071	-0.0076	-0.0075	-0.0068	-0.0053
0.45	-0.0072	-0.0075	-0.0072	-0.0060	-0.0037
0.50	-0.0072	-0.0073	-0.0068	-0.0049	-0.0010
0.55	-0.0072	-0.0070	-0.0060	-0.0033	
0.60	-0.0070	-0.0066	-0.0049	-0.0007	
0.65	-0.0068	-0.0062	-0.0035		
0.70	-0.0066	-0.0054	-0.0016		
0.75	-0.0063	-0.0044			
0.80	-0.0060	-0.0031			
0.85	-0.0054	-0.0013			
0.90	-0.0047				
0.95	-0.0037				
1.00	-0.0025				
1.05	-0.0010				

Negative torque coefficient [3]

8.6. Combined Thrust Coefficient, C_T

J\β0.75	15	20	25	30	35
0.0	0.172	0.212	0.227	0.230	0.225
0.1	0.158	0.205	0.229	0.230	0.226
0.2	0.141	0.194	0.226	0.230	0.228
0.3	0.124	0.179	0.220	0.230	0.230
0.4	0.105	0.160	0.209	0.230	0.232
0.5	0.083	0.140	0.193	0.232	0.235
0.6	0.060	0.117	0.174	0.224	0.237
0.7	0.034	0.093	0.151	0.208	0.238
0.8	0.006	0.068	0.128	0.190	0.235
0.9	-0.022	0.041	0.103	0.169	0.222
1.0	-0.054	0.014	0.078	0.147	0.205
1.1	-0.083	-0.015	0.053	0.123	0.186
1.2	-0.110	-0.045	0.028	0.098	0.164
1.3	-0.134	-0.074	0.002	0.073	0.140
1.4	-0.157	-0.101	-0.030	0.047	0.115
1.5	-0.181	-0.127	-0.059	0.021	0.090
1.6	-0.206	-0.152	-0.086	-0.011	0.066
1.7	-0.232	-0.176	-0.111	-0.044	0.042
1.8	-0.259	-0.201	-0.135	-0.069	0.018
1.9	-0.287	-0.225	-0.158	-0.093	-0.011
2.0	-0.314	-0.250	-0.181	-0.116	-0.040
2.1	-0.343	-0.276	-0.205	-0.139	-0.069
2.2	-0.371	-0.302	-0.229	-0.161	-0.090
2.3	-0.400	-0.330	-0.255	-0.184	-0.111
2.4	-0.429	-0.358	-0.281	-0.206	-0.132
2.5	-0.457	-0.387	-0.307	-0.228	-0.153
2.6	-0.486	-0.416	-0.335	-0.252	-0.174
2.7	-0.514	-0.445	-0.363	-0.275	-0.195
2.8	-0.542	-0.474	-0.391	-0.299	-0.217
2.9	-0.571	-0.503	-0.420	-0.323	-0.239
3.0	-0.600	-0.532	-0.449	-0.349	-0.262
3.1	-0.629	-0.562	-0.478	-0.375	-0.285
3.2	-0.659	-0.592	-0.507	-0.401	-0.308
3.3	-0.688	-0.621	-0.536	-0.426	-0.331
3.4	-0.720	-0.652	-0.567	-0.454	-0.356

$J \backslash \beta_{0.75}$	15	20	25	30	35
3.5	-0.754	-0.684	-0.598	-0.483	-0.383
3.6	-0.787	-0.716	-0.629	-0.512	-0.409
3.7	-0.821	-0.748	-0.660	-0.541	-0.435
3.8	-0.855	-0.779	-0.691	-0.569	-0.462
3.9	-0.888	-0.811	-0.722	-0.598	-0.488
4.0	-0.922	-0.843	-0.753	-0.627	-0.514
4.1	-0.965	-0.883	-0.790	-0.661	-0.546
4.2	-1.007	-0.922	-0.828	-0.696	-0.577
4.3	-1.050	-0.962	-0.866	-0.730	-0.609
4.4	-1.092	-1.001	-0.903	-0.765	-0.640
4.5	-1.135	-1.041	-0.941	-0.799	-0.672
4.6	-1.178	-1.081	-0.978	-0.834	-0.704
4.7	-1.220	-1.120	-1.016	-0.869	-0.735
4.8	-1.263	-1.160	-1.053	-0.903	-0.767
4.9	-1.306	-1.200	-1.091	-0.938	-0.798
5.0	-1.348	-1.239	-1.129	-0.972	-0.830

Combined thrust coefficient [2], [3]

8.7. Combined Power Coefficient, C_P

J\β0.75	15	20	25	30	35
0.0	0.075	0.117	0.164	0.231	0.305
0.1	0.075	0.117	0.164	0.228	0.302
0.2	0.074	0.116	0.163	0.226	0.297
0.3	0.072	0.114	0.163	0.224	0.291
0.4	0.067	0.111	0.162	0.222	0.283
0.5	0.059	0.106	0.160	0.221	0.275
0.6	0.049	0.097	0.155	0.221	0.274
0.7	0.036	0.085	0.145	0.219	0.280
0.8	0.021	0.069	0.131	0.212	0.283
0.9	0.002	0.051	0.115	0.200	0.279
1.0	-0.016	0.030	0.096	0.184	0.271
1.1	-0.034	0.009	0.075	0.164	0.260
1.2	-0.051	-0.018	0.050	0.142	0.244
1.3	-0.066	-0.042	0.022	0.117	0.222
1.4	-0.081	-0.064	-0.010	0.088	0.195
1.5	-0.096	-0.084	-0.042	0.056	0.164
1.6	-0.112	-0.103	-0.068	0.022	0.133
1.7	-0.129	-0.123	-0.094	-0.025	0.101
1.8	-0.146	-0.142	-0.120	-0.062	0.067
1.9	-0.164	-0.162	-0.145	-0.093	0.032
2.0	-0.182	-0.183	-0.170	-0.123	-0.017
2.1	-0.200	-0.205	-0.194	-0.152	-0.066
2.2	-0.219	-0.227	-0.219	-0.181	-0.106
2.3	-0.238	-0.250	-0.244	-0.210	-0.141
2.4	-0.258	-0.273	-0.270	-0.240	-0.174
2.5	-0.278	-0.297	-0.295	-0.269	-0.207
2.6	-0.299	-0.321	-0.322	-0.298	-0.239
2.7	-0.321	-0.345	-0.349	-0.328	-0.272
2.8	-0.342	-0.369	-0.376	-0.358	-0.305
2.9	-0.364	-0.395	-0.404	-0.388	-0.338
3.0	-0.386	-0.421	-0.434	-0.419	-0.371
3.1	-0.409	-0.448	-0.464	-0.451	-0.404
3.2	-0.431	-0.474	-0.494	-0.482	-0.437
3.3	-0.454	-0.501	-0.523	-0.513	-0.471
3.4	-0.478	-0.530	-0.555	-0.548	-0.507

J\β0.75	15	20	25	30	35
3.5	-0.503	-0.559	-0.589	-0.584	-0.544
3.6	-0.528	-0.589	-0.622	-0.620	-0.582
3.7	-0.553	-0.619	-0.655	-0.656	-0.619
3.8	-0.578	-0.649	-0.688	-0.692	-0.656
3.9	-0.602	-0.679	-0.721	-0.727	-0.694
4.0	-0.627	-0.709	-0.755	-0.763	-0.731
4.1	-0.656	-0.744	-0.794	-0.807	-0.776
4.2	-0.685	-0.779	-0.834	-0.850	-0.821
4.3	-0.714	-0.814	-0.874	-0.893	-0.866
4.4	-0.742	-0.850	-0.914	-0.936	-0.911
4.5	-0.771	-0.885	-0.954	-0.979	-0.957
4.6	-0.800	-0.920	-0.994	-1.023	-1.002
4.7	-0.829	-0.955	-1.033	-1.066	-1.047
4.8	-0.857	-0.990	-1.073	-1.109	-1.092
4.9	-0.886	-1.025	-1.113	-1.152	-1.137
5.0	-0.915	-1.060	-1.153	-1.196	-1.182

Combined power coefficient [2], [3]

9. Coefficients Converting Script

Python script converting propellers characteristics is listed below.

```
import sys
import math
import numpy

MPH_2_MPS = 0.44704
FT_2_M = 0.3048

def get_n(v,d,j):
    n = v / (j*d)
    return n

class DataInput(object):
    def __init__(self,v,d):
        self.v = v
        self.d = d
        self.args = []
        self.rows = []
        self.cols = []
        self.rows_no = 0
        self.cols_no = 0

    def read_file(self,in_file):
        data_file = open(in_file,"r")
        lines = data_file.readlines()
        data_file.close()
        lines = lines[2:]
        for line in lines:
            values = line.split(";")
            self.args.append(float(values[0]))
            values_rest = values[1:]
            row = []
            for value in values_rest:
                if len(value) > 0 and value != "\n":
                    row.append(float(value))
                else:
                    row.append(None)
            self.rows.append(row)
        self.rows_no = len(self.rows)
        self.rows_2_cols()

    def rows_2_cols(self):
        if len(self.rows) > 0:
```

```
            row = self.rows[0]
            self.cols_no = len(row)
        for ic in range(0,self.cols_no,1):
            col = []
            self.cols.append(col)
        for ic in range(0,len(self.cols),1):
            for ir in range(0,len(self.rows),1):
                self.cols[ic].append(self.rows[ir][ic])

    def ndv_2_j(self):
        result = []
        for arg in self.args:
            j = 1.0 / arg
            result.append( j )
        return result

    def qc_2_cp(self):
        cols_new = []
        for ic in range(0,len(self.cols),1):
            col = []
            cols_new.append(col)
        for ic in range(0,len(self.cols),1):
            cp = 0.0
            for ir in range(0,len(self.args),1):
                j = 1.0 / self.args[ir]
                n = get_n(self.v,self.d,j)
                qc = self.cols[ic][ir]
                if qc != None:
                    cp = 2.0 * math.pi * (self.v**2) * qc / ( (n**2) *
 (self.d**2) )
                cols_new[ic].append(cp)
        return cols_new

    def tc_2_ct(self):
        cols_new = []
        for ic in range(0,len(self.cols),1):
            col = []
            cols_new.append(col)
        for ic in range(0,len(self.cols),1):
            ct = 0.0
            for ir in range(0,len(self.args),1):
                j = 1.0 / self.args[ir]
                n = get_n(self.v,self.d,j)
                tc = self.cols[ic][ir]
                if tc != None:
                    ct = (self.v**2) * tc / ( (n**2) * (self.d**2) )
                cols_new[ic].append(ct)
        return cols_new
```

```
class DataOutput(object):
    def __init__(self,v,d):
        self.v = v
        self.d = d
        self.args = []
        self.cols = []
        self.rows_no = 0
        self.cols_no = 0

    def init_args(self,start,stop,step):
        arg = start
        while ( arg < stop ):
            self.args.append( arg )
            arg += step
            arg = round( arg, 2 )
        self.rows_no = len(self.args)

    def init_cols(self,args,cols):
        self.cols_no = len(cols)
        for ic in range(0,self.cols_no,1):
            col = []
            self.cols.append(col)
        for ic in range(0,self.cols_no,1):
            self.cols[ic] = numpy.interp(self.args,args,cols[ic])

    def write_file(self,out_file):
        data_file = open(out_file,"w")
        for ir in range(0,len(self.args),1):
            out = str(self.args[ir])
            for ic in range(0,len(self.cols),1):
                out += ";"
                value = self.cols[ic][ir]
                if value != None:
                    out += str(round(value,6))
            out += "\n"
            data_file.write(out)
        data_file.close()

def process(qc_in_file,tc_in_file,cp_out_file,ct_out_file):
    v = MPH_2_MPS*105.0
    d = FT_2_M*10.0

    data_in_qc = DataInput(v,d)
    data_in_tc = DataInput(v,d)
    data_in_qc.read_file(qc_in_file)
    data_in_tc.read_file(tc_in_file)
```

```
    args_cp = data_in_qc.ndv_2_j()
    cols_cp = data_in_qc.qc_2_cp()

    args_ct = data_in_tc.ndv_2_j()
    cols_ct = data_in_tc.tc_2_ct()

    args_cp.reverse()
    args_ct.reverse()

    for col in cols_cp:
        col.reverse()

    for col in cols_ct:
        col.reverse()

    data_out_cp = DataOutput(v,d)
    data_out_ct = DataOutput(v,d)

    data_out_cp.init_args(0.1,5.0+1e-9,0.1)
    data_out_ct.init_args(0.1,5.0+1e-9,0.1)

    data_out_cp.init_cols(args_cp,cols_cp)
    data_out_ct.init_cols(args_ct,cols_ct)

    data_out_cp.write_file(cp_out_file)
    data_out_ct.write_file(ct_out_file)

if len(sys.argv) == 5:
    qc_in_file = sys.argv[1]
    tc_in_file = sys.argv[2]
    cp_out_file = sys.argv[3]
    ct_out_file = sys.argv[4]
    process(qc_in_file,tc_in_file,cp_out_file,ct_out_file)
else:
    print("Usage:")
    print("convert.py qc_input_file tc_input_file cp_output_file
     ct_output_file")
```

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