ÖLÇME DEĞERLENDİRME
FORMÜL VE TABLOLAR

Birinci mertebe dinamik sistem : $c\dot{x} + kx = F(t)\ ,\ x(0) = x_o$

Basamak giriş cevabı: $\dfrac{x_t - x_\infty}{x_o - x_\infty} = e^{-\frac{t}{\tau}}$

Harmonik giriş cevabı: $F(t) = F_o \sin \omega t$ ise

$$x(t) = Ce^{-t/\tau} + \frac{A/a_o}{\left[1+(\omega\tau)^2\right]^{1/2}} \sin(\omega t - \phi) \quad , \quad \phi(\omega) = -\tan^{-1}(\omega\tau)$$

Genlikteki azalma : $\dfrac{1}{\left[1+(\omega\tau)^2\right]^{1/2}}$, $\Delta t = \dfrac{\phi(\omega)}{\omega}$

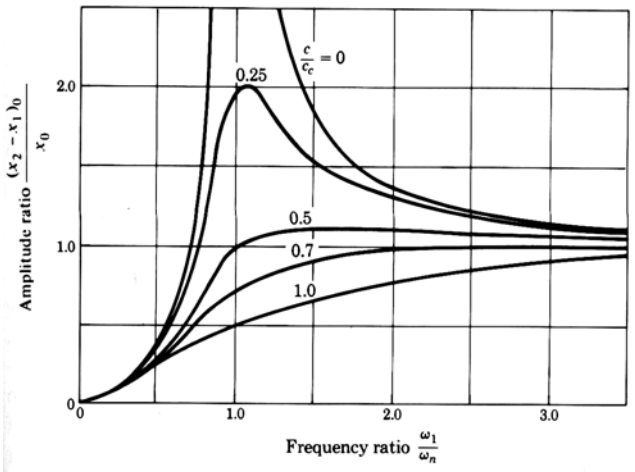
İkinci mertebe dinamik sistem : $m\ddot{x} + c\dot{x} + kx = F(t)\ ,\ x(0) = x_o\ ,\ \dot{x}(0) = v_o$

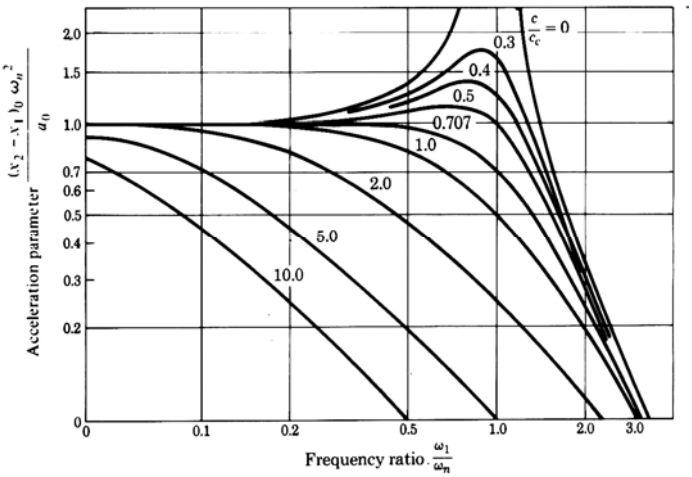
$\ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2 x = f_o \cos\omega_1 t$; (harmonik giriş) $\quad f_o = F_o / m$

$\omega_n = \sqrt{k/m}$; $\zeta = c/c_c$, $c_c = 2\sqrt{mk}$

$$\phi = \tan^{-1}\frac{2(c/c_c)(\omega_1/\omega_n)}{1-(\omega_1/\omega_n)^2} \quad ; \quad x(t) = \frac{(F_o/k)\cos(\omega_1 t - \phi)}{\sqrt{\left[1-(\omega_1/\omega_n)^2\right]^2 + \left[2(c/c_c)(\omega_1/\omega_n)\right]^2}}$$

Genlikler oranı : $\dfrac{1}{\sqrt{\left[1-(\omega_1/\omega_n)^2\right]^2 + \left[2(c/c_c)(\omega_1/\omega_n)\right]^2}}$





Hata Fonksiyonu Tablosu

$$erf\eta_1 = \frac{1}{\sqrt{\pi}} \int_{-\eta_1}^{+\eta_1} e^{-\eta^2} d\eta$$

η_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0000	00399	00798	01197	01595	01994	02392	02790	03188	03586
0.1	03983	04380	04776	05172	05567	05962	06356	06749	07142	07355
0.2	07926	08317	08706	09095	09483	09871	10257	10642	11026	11409
0.3	11791	12172	12552	12930	13307	13683	14058	14431	14803	15173
0.4	15554	15910	16276	16640	17003	17364	17724	18082	18439	18793
0.5	19146	19497	19847	20194	20450	20884	21226	21566	21904	22240
0.6	22575	22907	23237	23565	23891	24215	24537	24857	25175	25490
0.7	25084	26115	26424	26730	27035	27337	27637	27935	28230	28524
0.8	28814	29103	29389	29673	29955	30234	30511	30785	31057	31327
0.9	31594	31859	32121	32381	32639	32894	33147	33398	33646	33891
1.0	34134	34375	34614	34850	35083	35313	35543	35769	35993	36214
1.1	36433	36650	36864	37076	37286	37493	37698	37900	38100	38298
1.2	38493	38686	38877	39065	39251	39435	39617	39796	39973	40147
1.3	40320	40490	40658	40824	40988	41198	41308	41466	41621	41774
1.4	41924	42073	42220	42364	42507	42647	42786	42922	43056	43189
1.5	43319	43448	43574	43699	43822	43943	44062	44179	44295	44408
1.6	44520	44630	44738	44845	44950	45053	45154	45254	45352	45449
1.7	45543	45637	45728	45818	45907	45994	46080	46164	46246	46327
1.8	46407	46485	46562	46638	46712	46784	46856	46926	46995	47062
1.9	47128	47193	47257	47320	47381	47441	47500	47558	47615	47670
2.0	47725	47778	47831	47882	47932	47962	48030	48077	48124	48169
2.1	48214	48257	48300	48341	48382	48422	48461	48500	48537	48574
2.2	48610	48645	48679	48713	48745	48778	48809	48840	48870	48899
2.3	48928	48956	48983	49010	49036	49061	49086	49111	49134	49158
2.4	49180	49202	49224	49245	49266	49286	49305	49324	49343	49361
2.5	49379	49296	49413	49430	49446	49461	49477	49492	49506	49520
2.6	49534	49547	49560	49573	49585	49598	49609	49621	49632	49643
2.7	49653	49664	49674	49683	49693	49702	49711	49720	49728	49736
2.8	49744	49752	49760	49767	49774	49781	49788	49795	49801	49807
2.9	49813	49819	49825	49831	49836	49841	49846	49851	49856	49861
3.0	49865									
3.5	4997674									
4.0	4999683									
4.5	4999966									
5.0	4999997133									

Normal hata dağılımı

$$p(x) = \frac{1}{\sigma\sqrt{2\pi}} \; exp\left[-\frac{(x - x_m)^2}{2\sigma^2} \right] \qquad ; \qquad P = \frac{1}{\sqrt{2\pi}} \int_{-\eta_1}^{+\eta_1} exp(-\eta^2 / 2) d\eta$$

Chauvenet Kriteri Tablosu

Okuma Sayısı, n	d_{max}/σ
3	1.38
4	1.54
5	1.65
6	1.73
7	1.80
10	1.96
15	2.13
25	2.33
50	2.57
100	2.81

$$\Delta = \frac{t\sigma}{\sqrt{n}}$$

$$\Delta = \frac{z\sigma}{\sqrt{n}}$$

$$v = \frac{\left[\sigma_1^2/n_1 + \sigma_2^2/n_2\right]^2}{\frac{\left(\sigma_1^2/n_1\right)^2}{n_1 - 1} + \frac{\left(\sigma_2^2/n_2\right)^2}{n_2 - 1}}$$

$$t = \frac{x_{m1} - x_{m2}}{\left[\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right]^{1/2}}$$

$$w_R = \left[\left(\frac{\partial R}{\partial x_1} w_1\right)^2 + \left(\frac{\partial R}{\partial x_2} w_2\right)^2 + \ldots + \left(\frac{\partial R}{\partial x_n} w_n\right)^2\right]^{1/2}$$

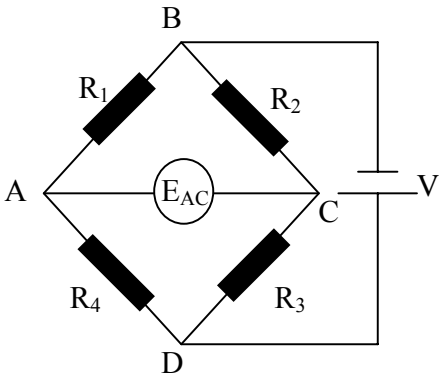
TABLE 3.7
Values of Student's *t* for use in Equation (3.44)
Subscript designates percent confidence level.

Degrees of freedom ν	t_{50}	t_{80}	t_{90}	t_{95}	t_{98}	t_{99}	$t_{99.9}$
1	1.000	3.078	6.314	12.706	31.821	63.657	636.619
2	0.816	1.886	2.920	4.303	6.965	9.925	31.598
3	0.765	1.638	2.353	3.182	4.541	5.841	12.941
4	0.741	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	1.476	2.015	2.571	3.365	4.032	6.859
6	0.718	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	1.415	1.895	2.365	2.998	3.499	5.405
8	0.706	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	1.319	1.714	2.069	2.500	2.807	3.767
24	0.685	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	1.303	1.684	2.021	2.423	2.704	3.551
60	0.679	1.296	1.671	2.000	2.390	2.660	3.460
120	0.677	1.289	1.658	1.980	2.358	2.617	3.373
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.291

Güvenilirlik aralığı	Güvenilirlik seviyesi, %	Önem Seviyesi, %
3.3	99.9	0.1
3	99.7	0.3
2.57	99	1
2	95.4	4.6
1.96	95	5
1.65	90	10

$$(x_2 - x_1)_o = \frac{x_o(\omega_1/\omega_n)^2}{\left\{\left[1-(\omega_1/\omega_n)^2\right]^2 + \left[2(c/c_c)(\omega_1/\omega_n)\right]^2\right\}^{1/2}} \qquad a_o = \omega_1^2 x_o$$

$$Q = \frac{C_d A_2}{\sqrt{1-(A_2/A_1)^2}}\sqrt{\frac{2(p_1-p_2)}{\rho}} \quad , \; (p_1-p_2) = (\rho_m - \rho)\cdot g \cdot h$$



$$p - p_a = gh(\rho_m - \rho_f) \qquad \rho = \frac{p}{RT} \qquad \mathbf{g}=9{,}81 \text{ m/s}^2$$

$$p_1 - p_2 = L\left(\sin\theta + A_2/A_1\right)\left(\rho_m - \rho\right)g$$

$$\rho_{Su} = 996 \text{ kg/m}^3 \qquad 1 \text{ atm} = 1.01325\times10^5 \text{ Pa}$$

$$1 \text{ bar} = 1\times10^5 \text{ Pa} \qquad R = 287{,}1 \text{ J/kg}\cdot\text{K}$$

$$c = 20.04T^{1/2} \quad m/s \qquad \rho = \frac{p}{RT} \qquad h = \frac{2\mu}{\rho c r^3}\sqrt{\frac{3LV}{\pi}} \qquad \omega_n = \sqrt{\frac{\pi r^2 c^2}{V(L+\pi^2 r^2/2)}}$$

$$\left|\frac{p}{p_o}\right| = \frac{1}{\left\{\left[1-(\omega_1/\omega_n)^2\right]^2 + \left[2h(\omega_1/\omega_n)\right]^2\right\}^{1/2}} \qquad \omega_n = \sqrt{\frac{\pi r^2 c^2}{V\left(L+0{,}5\pi r\right)}} \quad h = \frac{2\mu}{\rho c r^3}\sqrt{\frac{3LV}{\pi}}$$

$c=20.04\ T^{1/2}$ m/s