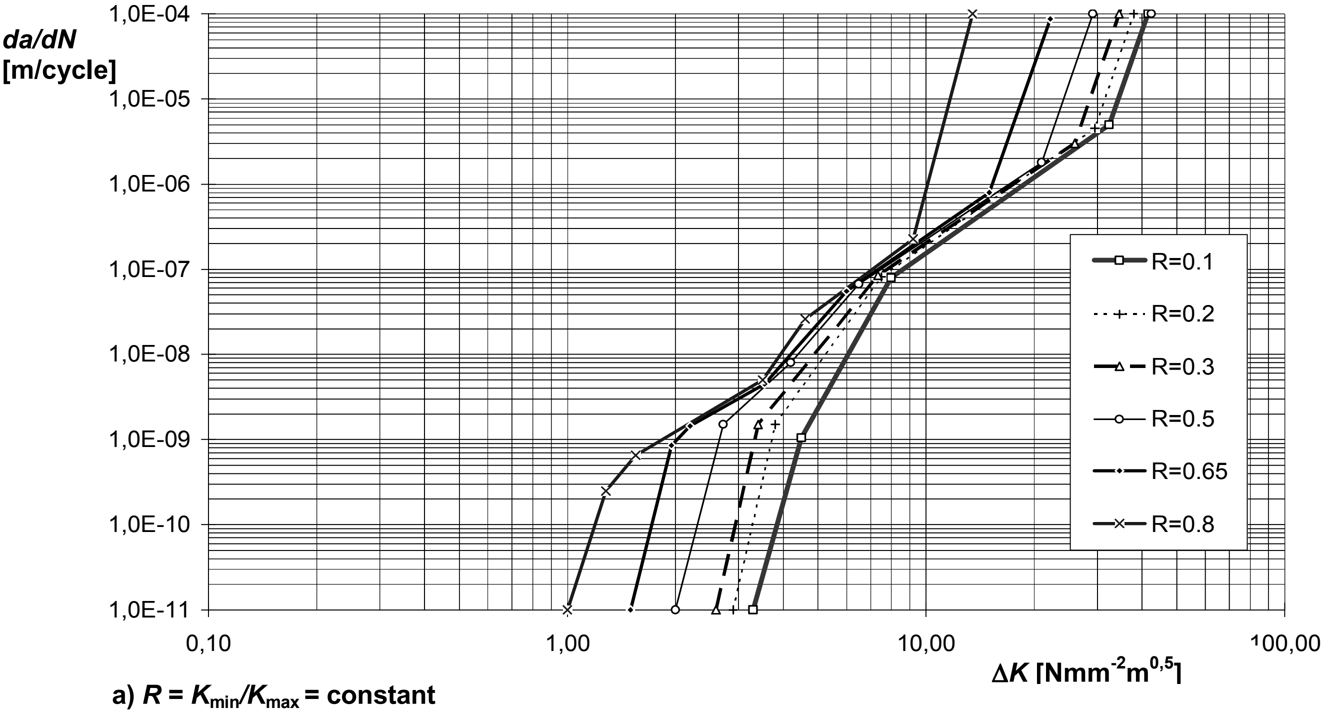
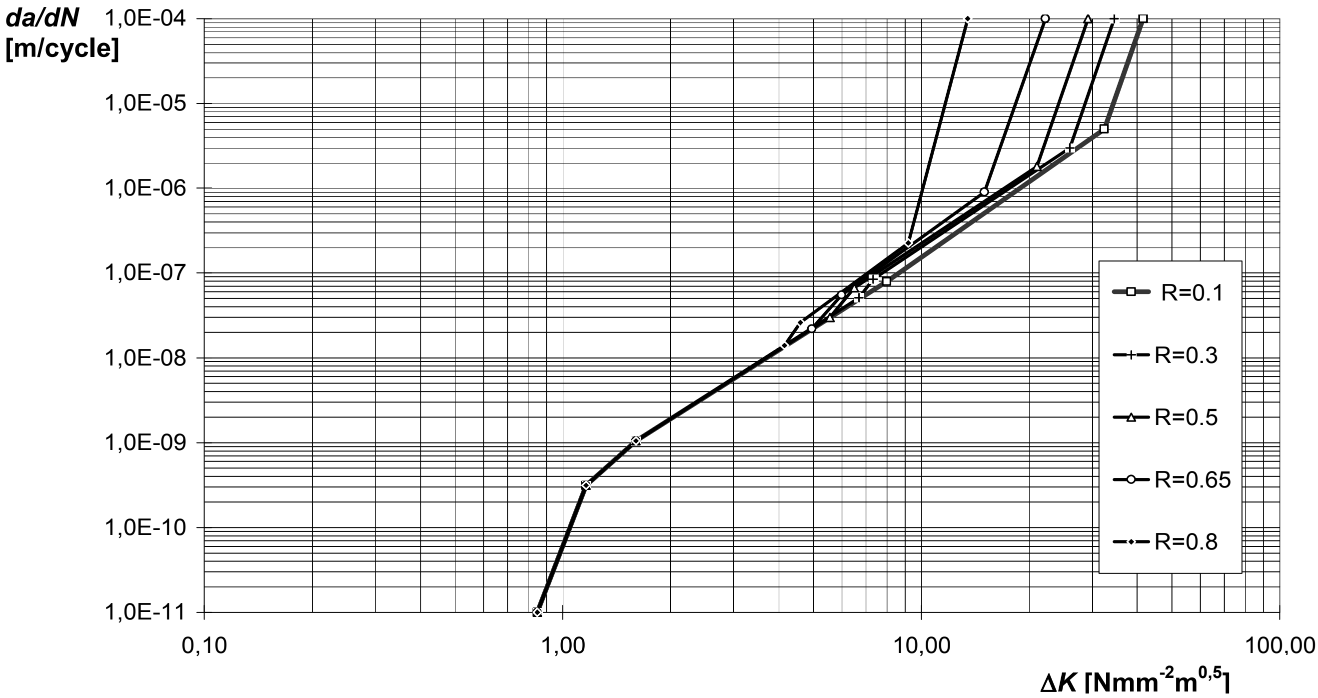


a) $R = K_{min}/K_{max}$ = constant



b) K_{max} = 10 Nmm^{-2}m^{0,5}

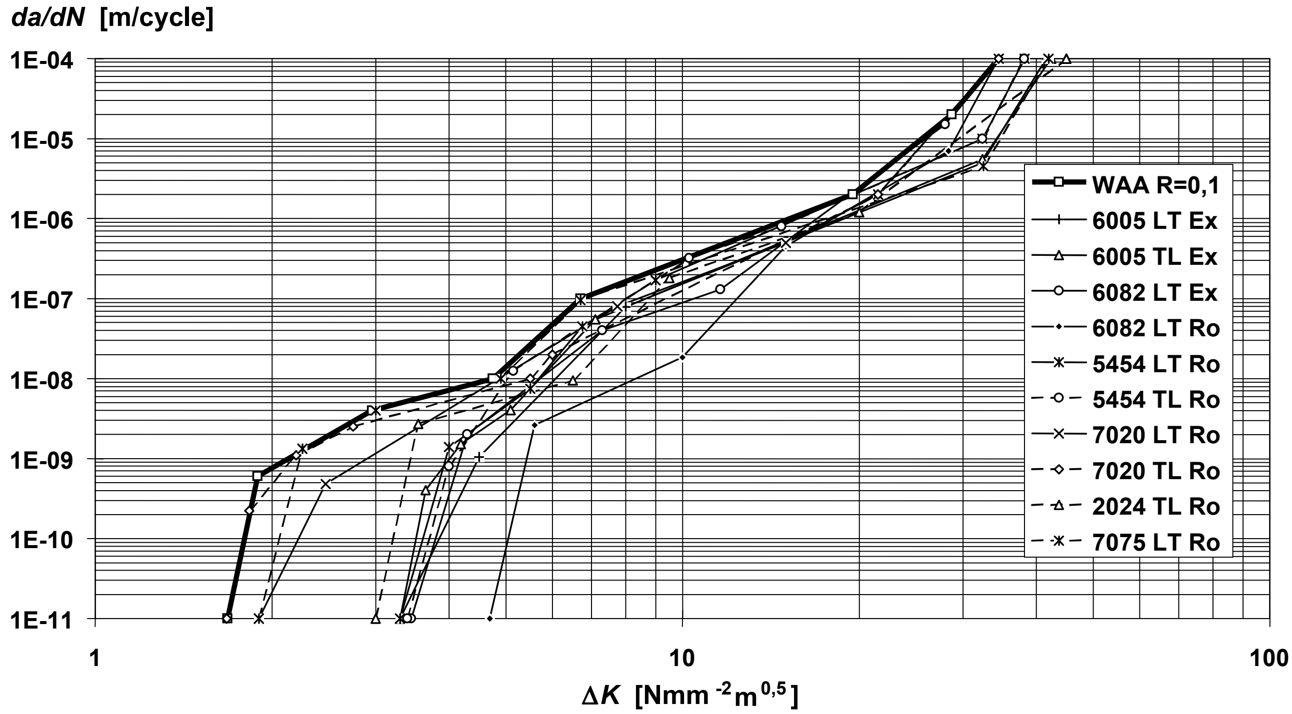
Figure B.3 – Typical fatigue crack growth curves for aluminium alloy EN AW-6005A T6 LT

Table B.1(a) — Fatigue crack growth rate data for EN AW-6005A T6 LT, $R = K_{min}/K_{max}$ = constant

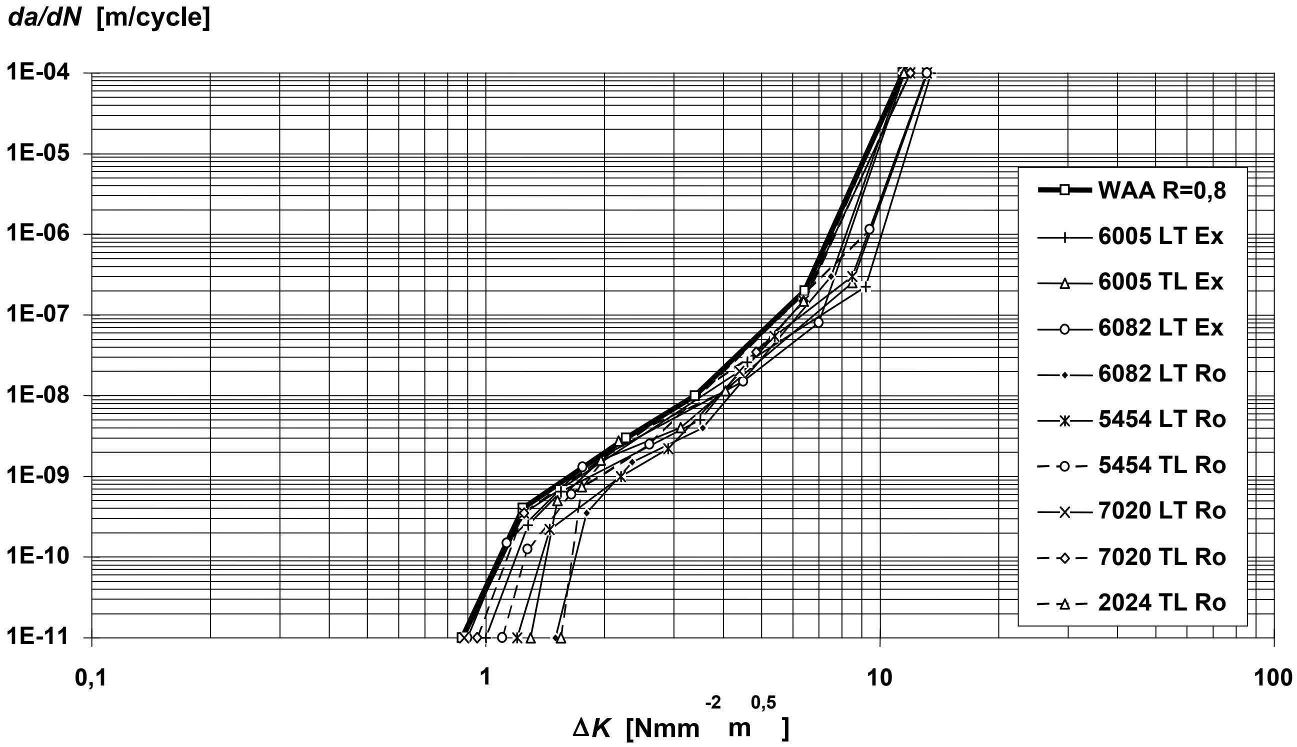
R-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*	*R*-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*
0,100	3,30	15,00	1,65789E-19	0,500	2,00	16,29	1,24322E-16
	4,50	7,52	1,29310E-14		2,72	3,85	3,17444E-11
	8,00	2,96	1,67380E-10		4,20	4,87	7,41477E-12
	32,4	12,0	4,10031E-24		6,50	2,81	3,50674E-10
	41,61	12,0	4,10031E-24		21,00	12,23	1,21158E-22
	60,00	12,0	4,10031E-24		29,17	12,23	1,21158E-22
					42,50	12,23	1,21158E-22
0,200	2,90	18,53	2,67965E-20	0,650	1,50	16,93	1,04285E-14
	3,80	5,87	5,94979E-13		1,95	4,43	4,41861E-11
	7,50	2,93	2,22754E-10		2,20	2,39	2,20681E-10
	29,60	12,43	2,25338E-24		3,55	4,77	1,06838E-11
	37,98	12,43	2,25338E-24		6,00	3,05	2,32639E-10
	55,00	12,43	2,25338E-24		15,00	12,00	6,08450E-21
					22,18	12,00	6,08450E-21
0,300	2,60	18,67	1,77471E-19	0,800	1,00	13,03	9,99999E-12
	3,40	5,24	2,47080E-12		1,28	4,99	7,28970E-11
	7,35	2,82	3,06087E-10		1,55	2,50	2,16851E-11
	26,00	12,40	8,41151E-24		3,50	6,03	2,61124E-12
	34,49	12,40	8,41151E-24		4,60	3,12	2,22506E-10
	50,00	12,40	8,41151E-24		9,20	15,93	9,83032E-23
					13,48	15,93	9,83032E-23

Table B.1(b) – Fatigue crack growth rate data for EN AW-6005A-T6 LT, K_{max} = 10 $Nmm^{-2}m^{0,5}$ = constant

R-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*	*R*-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*M*	*A*
0,100	0,85	11,09	6,06810E-11	0,500	0,85	11,09	6,06910E-11
	1,16	3,74	1,80712E-10		1,16	3,74	1,80712E-10
	1,60	2,69	2,96984E-10		1,60	2,70	2,95817E-10
	8,00	2,96	1,67380E-10		5,55	5,09	4,92250E-12
	32,40	12, 0	4,10322E-24		6,50	2,81	3,50674E-10
	41,61	12, 0	4,10322E-24		21,00	12,20	1,20951E-22
					29,17	12,20	1,20951E-22
0,300	0,85	11,09	6,06910E-11	0,650	0,85	11,09	6,06910E-11
	1,16	3,74	1,80712E-10		1,16	3,74	1,80712E-10
	1,60	2,71	2,93585E-10		1,60	2,69	2,96037E-10
	6,70	5,52	1,41317E-12		4,95	4,76	1,08127E-11
	7,35	2,82	3,06087E-10		6,00	3,05	2,32639E-10
	26,00	12,40	8,42100E-24		15,00	12,04	6,08100E-21
	34,49	12,40	8,42100E-24		22,18	12,04	6,08100E-21
				0,800	0,85	11,09	6,06910E-11
					1,16	3,74	1,80712E-10
					1,60	2,72	2,92718E-10
					4,15	6,01	2,68983E-10
					4,60	3,12	2,22506E-10
					9,20	15,93	9,81913E-23
					13,48	15,93	9,81913E-23



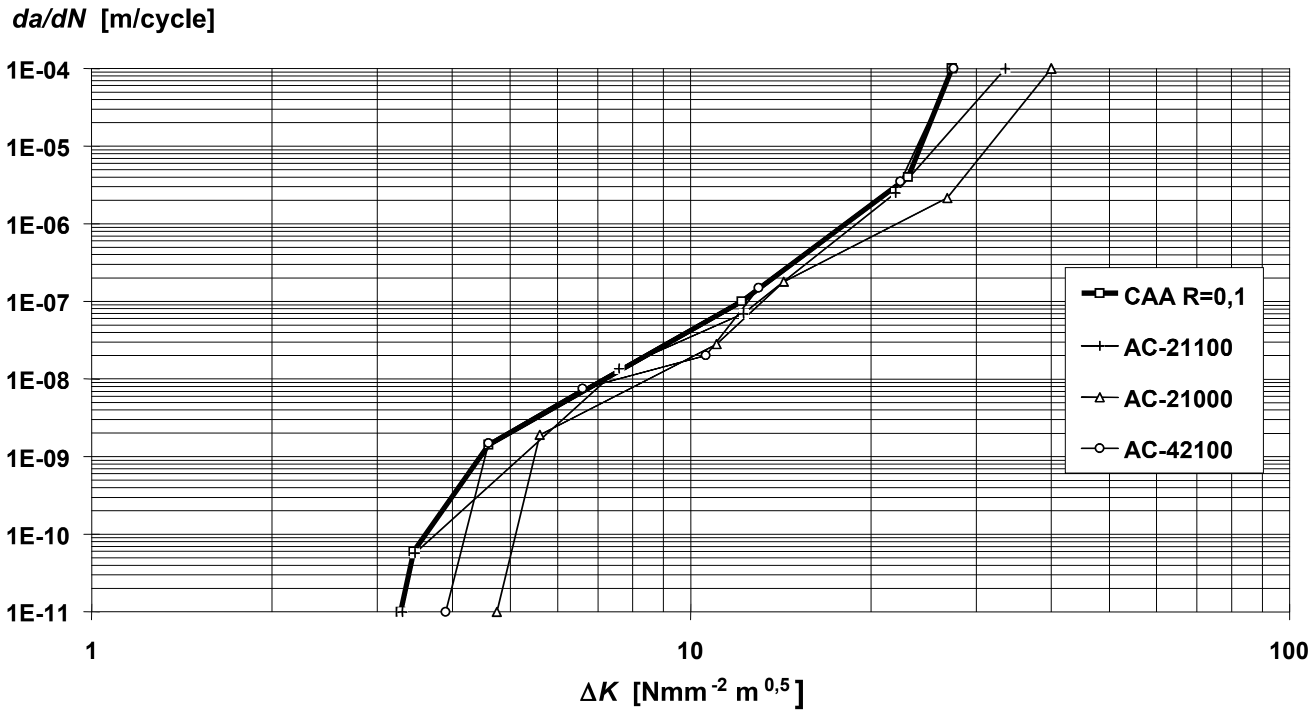
a) $R = 0,1$



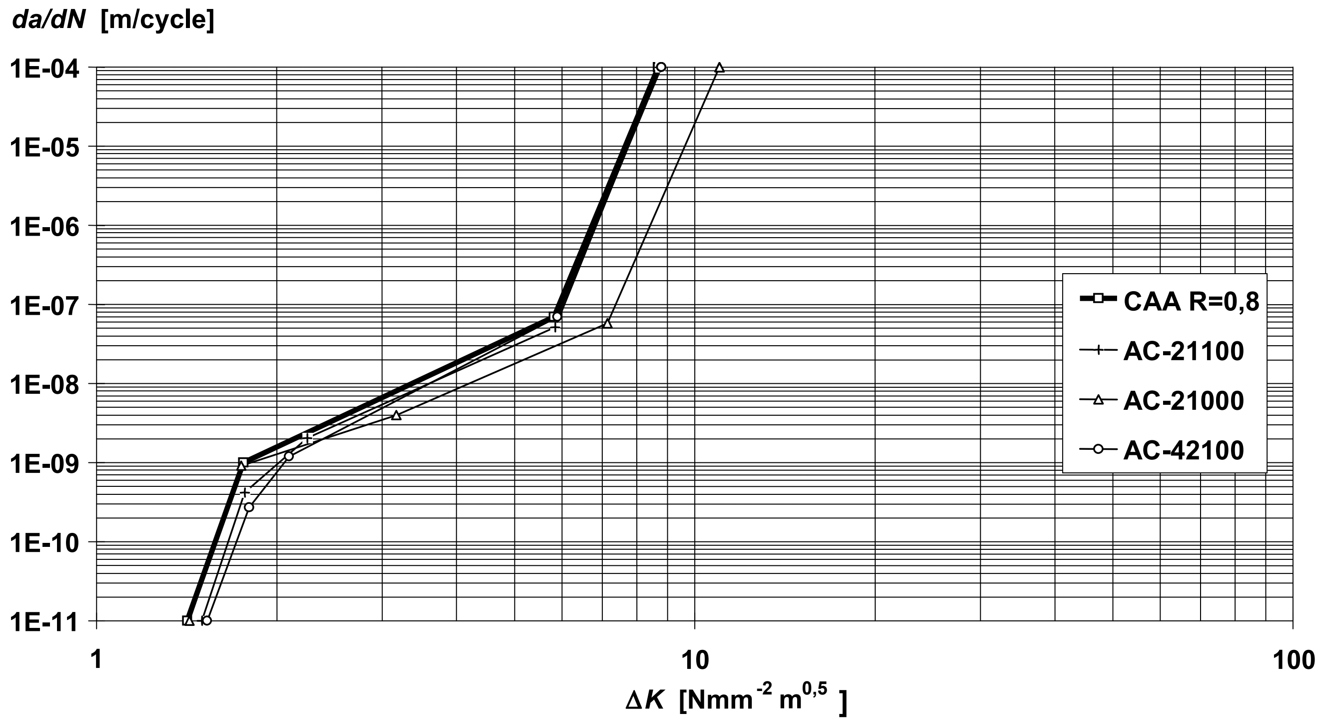
b) $R = 0,8$

Figure B.4 – Typical fatigue crack growth rate curves for various wrought alloys

NOTE The alloys 2024 TL Ro and 7075 LT Ro are not recommended for buildings and civil engineering works. They are given here for comparative reasons.



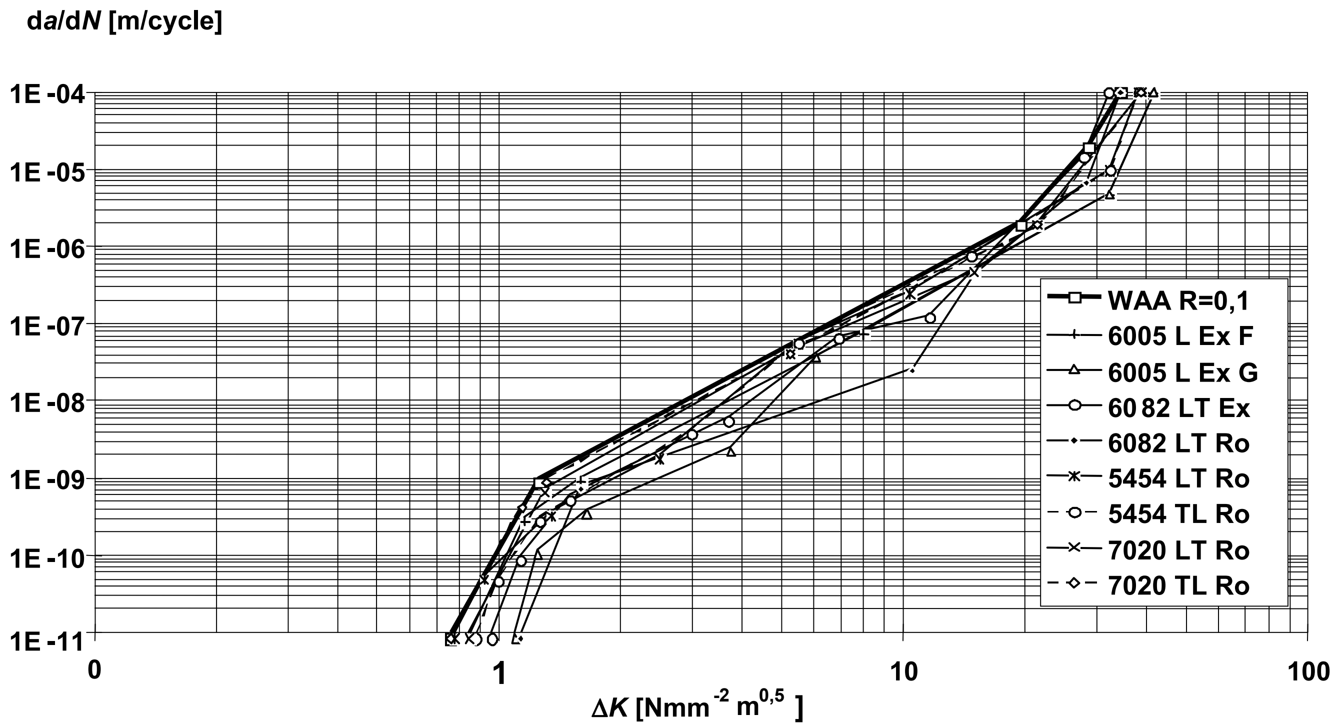
a) $R = 0,1$



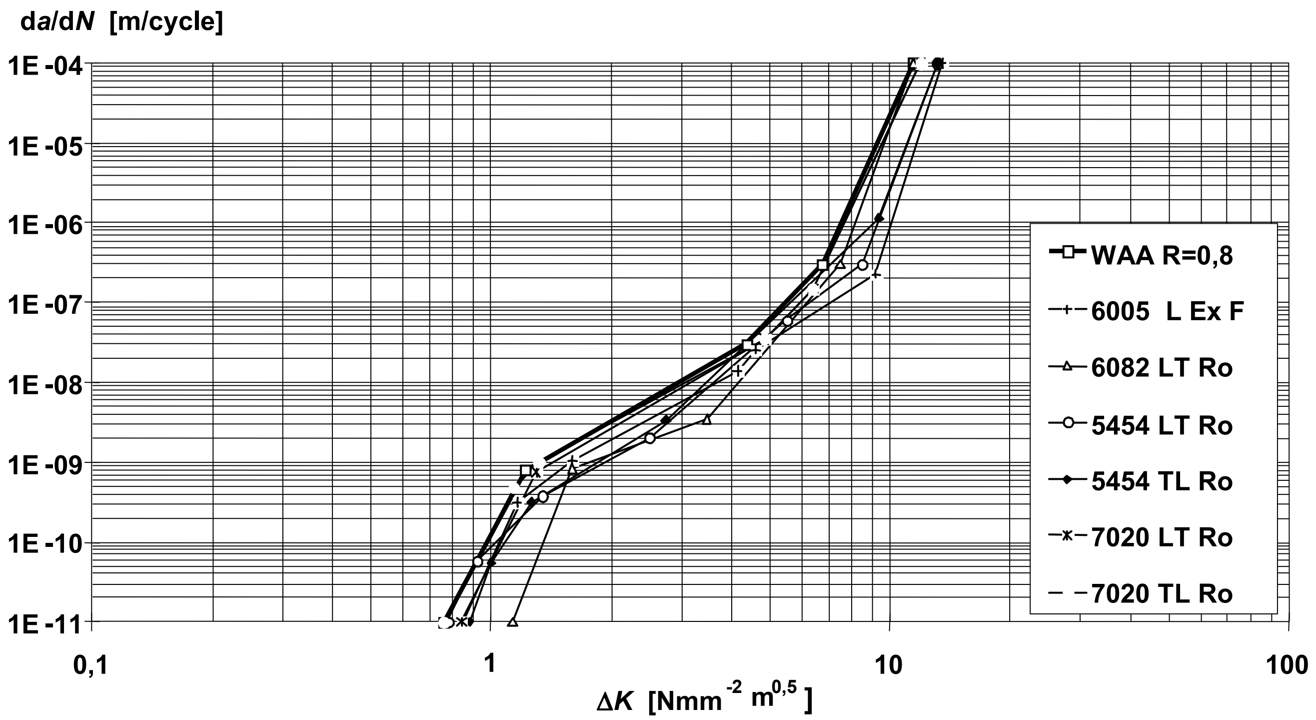
b) $R = 0,8$

Figure B.5 – Typical fatigue crack growth curves for various cast alloys

NOTE The alloys AC-21100 and AC-211000 are not recommended for buildings and civil engineering works. They are given here for comparative reasons.



a) $R = 0{,}1$; $K_{max} = 10$ Nmm^{-2}m^{0,5}



b) $R = 0{,}8$; $K_{max} = 10$ Nmm^{-2}m^{0,5}

Figure B.6 – Typical fatigue crack growth curves for various wrought alloys

Table B.2 – Fatigue crack growth rate data for wrought alloys, $R = K_{min}/K_{max}$=constant

R-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*
a) 0,100	1,68	34,8	1,47182E-19
	1,89	4,23	4,06474E-11
	2,96	1,94	4,88644E-10
	4,75	6,69	2,95135E-13
	6,70	2,80	4,82538E-10
	19,51	5,96	4,12350E-14
	28,70	8,74	3,57541E-18
	34,50	8,74	3,57541E-18
b) 0,800	0,87	10,43	4,27579E-11
	1,24	3,33	1,95935E-10
	2,27	2,98	2,60324E-10
	3,40	4,69	3,24644E-11
	6,44	10,8	3,73040E-16
	11,45	10,8	3,73040E-16

NOTE These values are upper bound envelopes derived from curves in Figure B.4(a) and (b).

Table B.3 —Fatigue crack growth rate cast alloys $R = K_{min}/K_{max}$ = constant

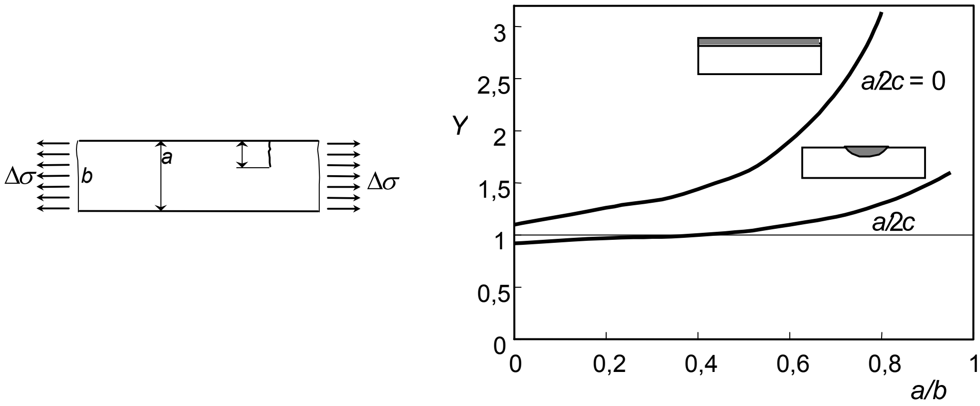
R-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*
a) 0,100	3,28	35,46	5,10219E-30
	3,45	11,01	7,18429E-17
	4,60	4,37	1,82159E-12
	12,18	5,78	5,37156E-14
	23,07	19,12	3,47503E-32
	27,30	19,12	3,47503E-32
b) 0,800	1,42	21,24	6,08486E-15
	1,76	3,55	1,34235E-10
	5,82	18,1	1,05480E-21
	8,70	18,1	1,05480E-21

NOTE Values are upper bound envelopes derived from curves in Figure B.5(a) and (b).

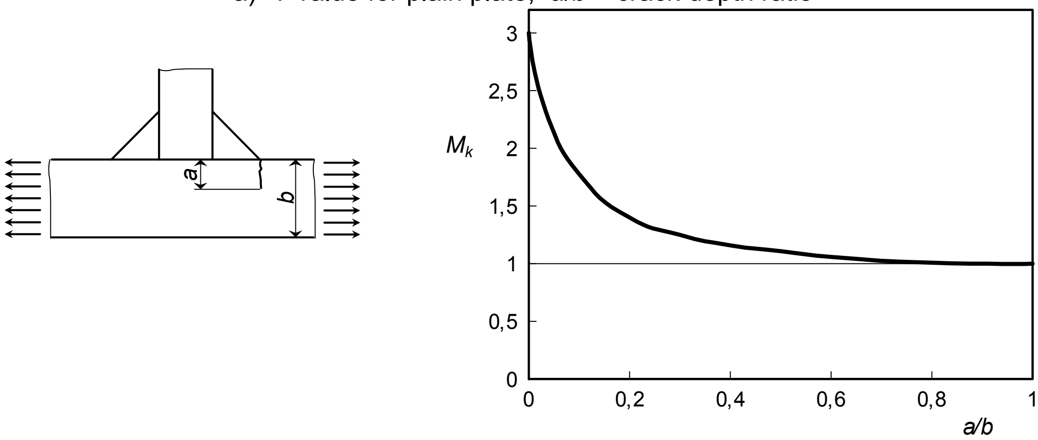
Table B.4 – Fatigue crack growth rate data for wrought alloys, *K*max=10 Nmm-2m0,5 = constant

R-ratio	Stress Intensity ΔK [$Nmm^{-2}m^{0,5}$]	*m*	*A*
0,100	0,76	9,13	1,21148E-10
	1,26	2,77	5,26618E-10
	19,50	5,95	4,18975E-14
	28,71	8,79	3,07173E-18
	34,48	8,79	3,07173E-18
0,800	0,76	9,27	1,27475E-10
	1,22	2,84	4,56026E-10
	4,37	5,28	1,24266E-11
	6,76	11,02	2,12818E-16
	11,45	11,02	2,12818E-16

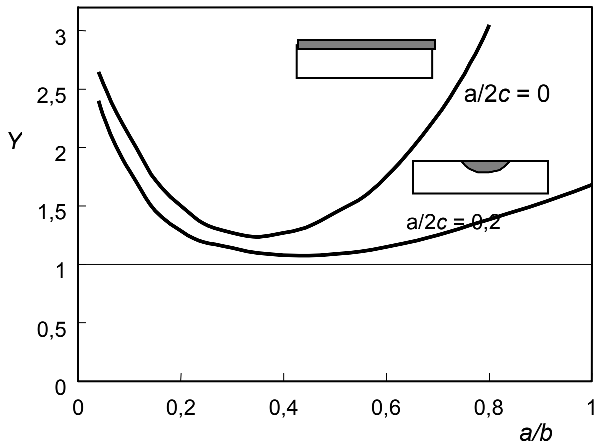
NOTE Values are upper bound envelopes derived from curves in Figure B.6(a) and (b).



a) *Y* value for plain plate; *a*/*b* = crack depth ratio



b) M_k value for weld toe stress concentration



c) *Y* values for welded joint

Figure B.7 – Use of typical standard geometry solutions for *Y* and M_k

Annex C [informative]: Testing for fatigue design

C.1 General

(1) Where there are insufficient data for complete verification of a structure by calculations in accordance with 2.2.1 or 2.2.2, supplementary evidence should be provided by a specific testing programme. In this case test data may be required for one or more of the following reasons:

a) The applied load history or spectrum, for either single or multiple loads, is not available and is beyond practical methods of structural calculations (see 2.3.1 and 2.3.2). This may apply particularly to moving, hydraulically or aerodynamically loaded structures where dynamic or resonance effects can occur;

b) the geometry of the structure is so complex that estimates of member forces or local stress fields can not be obtained by practical methods of calculations (see 5.2 and 5.4);

c) the materials, dimensional details, or methods of manufacture of members or joints are different from those given in detail category tables;

d) crack growth data are needed for damage tolerant design verification.

(2) Testing may be carried out on complete prototypes, on structures equal to the one to be built or on component parts thereof. The type of information being derived from the test should take into account the degree to which the loading, materials, constructional details and methods of manufacture of the test structure or components thereof reflect the structure to be built.

(3) Test data should only be used in lieu of standard data if it is obtained and applied using controlled procedures.

C.2 Derivation of action loading data

C.2.1 Fixed structures subject to mechanical action

(1) This includes structures such as bridges, crane girders and machinery supports. Existing similar structures subject to the same loading sources may be used to obtain the amplitude, phasing and frequency of the applied loads.

(2) Strain, deflection or acceleration transducers fixed to selected components which have been calibrated under known applied loads can record the force pattern over a typical working period of the structure, using analog or digital data acquisition equipment. The components should be selected in such a way that the main load components can be independently deduced using the influence coefficients obtained from the calibration loads.

(3) Alternatively load cells can be mounted at the interfaces between the applied load and the structure and a continuous record obtained using the same equipment.

(4) The mass, stiffness and logarithmic decrement of the test structure should be within 30% of that in the final design and the natural frequency of the modes giving rise to the greatest strain fluctuations should be within 10%. If this is not the case the loading response should be subsequently verified on a structure made to the final design.

(5) The frequency component of the load spectrum obtained from the working period should be multiplied by the ratio of the design life to the working period to obtain the final design spectrum. Allowance for growth in intensity or frequency, or statistical extrapolation from measured period to design life should also be made as required.