Forschungszentrum Karlsruhe
Technik und Umwelt

Wissenschaftliche Berichte
FZKA 6169

An Analysis of Stresses and Stress Intensity Factors in 3- and 4-point Bending Bars

T. Fett

Institut für Materialforschung

November 1998

FORSCHUNGSZENTRUM KARLSRUHE

Technik und Umwelt

Wissenschaftliche Berichte

FZKA 6169

An analysis of stresses and stress intensity factors in 3- and 4-point bending bars

T. Fett

Institut für Materialforschung

Forschungszentrum Karlsruhe GmbH, Karlsruhe

1998

Als Manuskript gedruckt

Forschungszentrum Karlsruhe GmbH
Postfach 3640, 76021 Karlsruhe

Mitglied der Hermann von Helmholtz-Gemeinschaft
Deutscher Forschungszentren (HGF)

ISSN 0947-8620

Abstract

In many standards for toughness determination ideal beam configurations are included. The roller arrangement is assumed to be completely symmetrical and the edge crack has to be located in the centre of the loading fixture. In practice, finite tolerances in machining of the test fixtures and small misalignments with respect to centering the cracked specimen have to be expected.
This report deals with the computation of stresses and mode I and mode II stress intensity factors for beam specimens loaded in not ideal test fixtures and showing small eccentricities of the crack. Three-point and four-point loaded bars are considered. The results are expressed by geometric functions and compiled in the form of tables.

Kurzfassung

Eine Analyse der Spannungen und Spannungsintensitätsfaktoren für 3- und 4-Punkt-Biegestäbe

In den Normen zut Bestimmung der Rißzähigkeit wird stets von idealen Bedingungen bezüglich der Symmetrie der Belastungsvorrichtung und der Lage des Risses in der Probe ausgegangen. In der Praxis wird es jedoch immer zu geringen Unsymmetrien als Folge von Fertigungstoleranzen und Ungenauigkeiten in der Anordnung der Probe gegenüber der Belastungsvorrichtung kommen. Um deren Einfluß auf die Mode-I und Mode-II Spannungsintensitätsfaktoren abschätzen zu können, wurden für einen großen Bereich an Exzentrizitäten analytische Berechnungen durchgeführt. Die Ergebnisse werden als Geometriefunktionen in Form von Tabellen mitgeteilt.

Contents

1 Introduction

The bending test is applied very often to determine strength and toughness data of brittle materials. This test seems to be the best investigated strength test with respect to the assessment of measuring faults. This is mainly due to the investigations of Baratta [1] and Quinn and Morrell [2]. Nevertheless, there remain some uncertainties due to test inaccuracies especially in toughness tests.

In many standards for toughness determination (e.g. ASTM E 399 for plain-strain fracture toughness of metallic materials, ASTM PS070 for the determination of fracture toughness of advanced ceramics at ambient temperature, CEN/TC 184 WI 100) ideal beam configurations are included. The roller arrangement is assumed to be completely symmetrical and the edge crack has to be located in the centre of the loading fixture. Practical considerations, however, necessitate tolerances in both the machining of the test fixtures and the centering of the cracked specimen for fracture toughness testing. An additional source of error is the tolerance applied to the centering alignment of the cracked beam between supports.

In this report the effects of both the misaligned load and the crack on the associated mode I and mode II stress intensity factors for beam specimens are computed for a wide range of eccentricities and crack sizes. Two configurations, the cracked three-point and four-point loaded bending bars are considered as test specimens.

Analytical computations of the stresses in the bar are made which illustrate as a by-product the deviations from elementary beam considerations. From these stresses the mode-I/mode-II stress intensity factors were computed by use of the fracture mechanics weight function. The results are expressed by geometric functions and compiled in the form of tables.

2 Stresses in bending bars

2.1 Stresses in a 3-point bending specimen

The loading situation of a 3-point bending test is illustrated in Fig. 1.

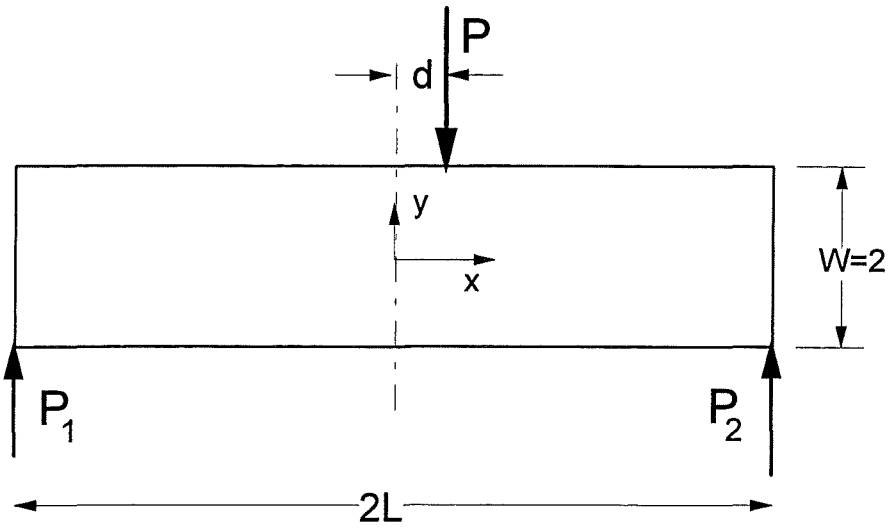

Fig. 1 Three-point bending test (including nonsymmetric loading), thickness *t*.

For the special case of a symmetric load application (d=0), Filon [3] provided the solution for the normal stress

$$\sigma_x = -\frac{3yPL}{tW^3} - \frac{2P}{tL}\sum_{n=1}^{\infty}\frac{\sinh(mW/2)-\frac{1}{2}mW\cosh(mW/2)}{mW+\sinh(mW)}\cos(mx)\cosh(my)$$

$$-\frac{2P}{tL}\sum_{1}^{\infty}\frac{my\sinh(mW/2)}{mW+\sinh(mW)}\cos(mx)\sinh(my) \qquad (1)$$

$$-\frac{2P}{tL}\sum_{n=0}^{\infty}\frac{\cosh(MW/2)-\frac{1}{2}MW\sinh(MW/2)}{\sinh(MW)-MW}\cos(Mx)\sinh(My)$$

$$-\frac{2P}{tL}\sum_{0}^{\infty}\frac{My\cosh(MW/2)}{\sinh(MW)-MW}\cos(Mx)\cosh(My)$$

and for the shear stress

$$\tau_{xy} = \frac{2P}{tL}\sum_{n=1}^{\infty}\frac{\frac{1}{2}mW\cosh(mW/2)}{mW+\sinh(mW)}\cos(mx)\cosh(my)$$

$$-\frac{2P}{tL}\sum_{1}^{\infty}\frac{my\sinh(mW/2)}{mW+\sinh(mW)}\sin(mx)\cosh(my)$$

$$+\frac{2P}{tL}\sum_{n=0}^{\infty}\frac{\frac{1}{2}MW\sinh(MW/2)}{\sinh(MW)-MW}\sin(Mx)\cosh(My)$$

$$-\frac{2P}{tL}\sum_{0}^{\infty}\frac{My\cosh(MW/2)}{\sinh(MW)-MW}\sin(Mx)\sinh(My) \qquad (2)$$

$$m=\frac{2n\pi}{L},\quad M=\frac{(2n+1)\pi}{L}$$

To the knowledge of the authors no solution exists for the general case, $d\neq 0$. Therefore, the stresses in the general case were derived in the following way:

The stresses in a rectangular plate are analytically known for any stress distribution $q_u(x)$ at the upper and $q_l(x)$ at the lower surface. It results (see e.g. Timoshenko and Goodier [4]) $\alpha=m\pi/L$

$$\sigma_x = \sum_{m=0}^{\infty}(A_m+B_m)\frac{(\alpha c\cosh\alpha c-\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\sin\alpha x+$$

$$+(A_m-B_m)\frac{(\alpha c\sinh\alpha c-\cosh\alpha c)\sinh\alpha y-\alpha y\cosh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\sin\alpha x+$$

$$+\sum_{m=0}^{\infty}(A'_m+B'_m)\frac{(\alpha c\cosh\alpha c-\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\cos\alpha x+$$

$$+(A'_m-B'_m)\frac{(\alpha c\sinh\alpha c-\cosh\alpha c)\sinh\alpha y-\alpha y\cosh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\cos\alpha x \qquad (3)$$

$$\sigma_y = -\sum_{m=0}^{\infty}(A_m+B_m)\frac{(\alpha c\cosh\alpha c+\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\sin\alpha x+$$

$$+(A_m-B_m)\frac{(\alpha c\sinh\alpha c+\cosh\alpha c)\sinh\alpha y-\alpha y\cosh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\sin\alpha x-$$

$$-\sum_{m=0}^{\infty}(A'_m+B'_m)\frac{(\alpha c\cosh\alpha c+\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\cos\alpha x+$$

$$+(A'_m - B'_m)\frac{(\alpha c \sinh\alpha c + \cosh\alpha c)\sinh\alpha y - \alpha y \cosh\alpha y \cosh\alpha c}{\sinh 2\alpha c - 2\alpha c}\cos\alpha x \tag{4}$$

$$\tau_{xy} = \sum_{m=0}^{\infty}(A_m + B_m)\frac{\alpha c \cosh\alpha c \sinh\alpha y - \alpha y \cosh\alpha y \sinh\alpha c}{\sinh 2\alpha c + 2\alpha c}\cos\alpha x +$$

$$(A_m - B_m)\frac{\alpha c \sinh\alpha c \cosh\alpha y - \alpha y \sinh\alpha y \cosh\alpha c}{\sinh 2\alpha c - 2\alpha c}\cos\alpha x -$$

$$-\sum_{m=0}^{\infty}(A'_m + B'_m)\frac{\alpha c \cosh\alpha c \sinh\alpha y - \alpha y \cosh\alpha y \sinh\alpha c}{\sinh 2\alpha c + 2\alpha c}\sin\alpha x +$$

$$-(A'_m - B'_m)\frac{\alpha c \sinh\alpha c \cosh\alpha y - \alpha y \sinh\alpha y \cosh\alpha c}{\sinh 2\alpha c - 2\alpha c}\sin\alpha x \tag{5}$$

with special treatment for the m=0 terms. (Note: y-direction different from Timoshenko's notation).

The Fourier coefficients are given by

$$A'_m = \frac{1}{L}\int_{-L}^{L} q_u(x)\cos\frac{m\pi x}{L}\,dx \tag{6a}$$

$$B'_m = \frac{1}{L}\int_{-L}^{L} q_l(x)\cos\frac{m\pi x}{L}\,dx \tag{6b}$$

$$A_m = \frac{1}{L}\int_{-L}^{L} q_u(x)\sin\frac{m\pi x}{L}\,dx \tag{6c}$$

$$B_m = \frac{1}{L}\int_{-L}^{L} q_l(x)\sin\frac{m\pi x}{L}\,dx \tag{6d}$$

If we now introduce the point forces

$$P_1 = P\frac{L-d}{2L}, \quad P_2 = P\frac{L+d}{2L} \tag{7}$$

by traction distributions using the Dirac δ-function

$$q_l(x) = P_1\delta(x+L) + P_2\delta(x-L), \quad q_u(x) = P\delta(x-d) \tag{8}$$

the coefficients simply result as

$$A'_m = \frac{P}{L}\cos\frac{m\pi d}{L}, \quad A_m = \frac{P}{L}\sin\frac{m\pi d}{L}$$

$$B'_m = \frac{P_1+P_2}{L}\cos(m\pi) = (-1)^m\frac{P_1+P_2}{L}, \quad B_m = -\frac{P_1-P_2}{L}\sin(m\pi) = 0$$

$$\Rightarrow \qquad B'_m = (-1)^m\frac{P}{L}$$

The x-component reads

$$\sigma_x = \sum_{m=1}^{\infty}\frac{P}{Lt}\sin\frac{m\pi d}{L}\frac{(\alpha c\cosh\alpha c-\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\sin\alpha x+$$

$$+\frac{P}{Lt}\sin\frac{m\pi d}{L}\frac{(\alpha c\sinh\alpha c-\cosh\alpha c)\sinh\alpha y-\alpha y\cosh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\sin\alpha x$$

$$+\sum_{m=1}^{\infty}\frac{P}{Lt}\left(\cos\frac{m\pi d}{L}+(-1)^m\right)\frac{(\alpha c\cosh\alpha c-\sinh\alpha c)\cosh\alpha y-\alpha y\sinh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\cos\alpha x+$$

$$+\frac{P}{Lt}\left(\cos\frac{m\pi d}{L}-(-1)^m\right)\frac{(\alpha c\sinh\alpha c-\cosh\alpha c)\sinh\alpha y-\alpha y\cosh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\cos\alpha x$$

$$-\frac{3PL}{2W^2t}\frac{y}{c}(1-d^2/L^2) \tag{9}$$

and the shear stress is given as

$$\tau_{xy} = \sum_{m=1}^{\infty}\frac{P}{Lt}\sin\frac{m\pi d}{L}\frac{\alpha c\cosh\alpha c\sinh\alpha y-\alpha y\cosh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\cos\alpha x+$$

$$+\frac{P}{Lt}\sin\frac{m\pi d}{L}\frac{\alpha c\sinh\alpha c\cosh\alpha y-\alpha y\sinh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\cos\alpha x$$

$$-\sum_{m=1}^{\infty}\frac{P}{Lt}\left(\cos\frac{m\pi d}{L}+(-1)^m\right)\frac{\alpha c\cosh\alpha c\sinh\alpha y-\alpha y\cosh\alpha y\sinh\alpha c}{\sinh 2\alpha c+2\alpha c}\sin\alpha x-$$

$$-\frac{P}{Lt}\left(\cos\frac{m\pi d}{L}-(-1)^m\right)\frac{\alpha c\sinh\alpha c\cosh\alpha y-\alpha y\sinh\alpha y\cosh\alpha c}{\sinh 2\alpha c-2\alpha c}\sin\alpha x \tag{10}$$

Figure 2 shows the x-stress component over the cross section for different values of d/W. The stress is normalised to the stress σ_0 defined as

$$\sigma_0 = \frac{3PL}{W^2t} \tag{11}$$

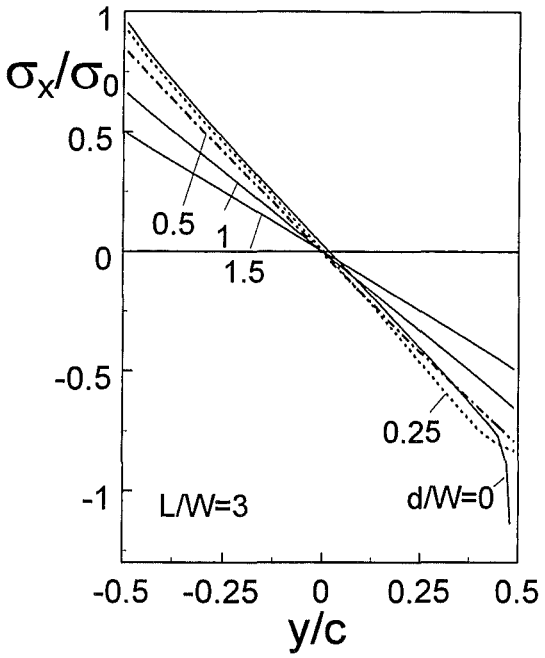

Fig.2 Stress distribution in 3-point bending test with misalignment.

Figure 3a shows the maximum tensile stress as a function of the distance x from the symmetry axis for symmetric loading (d=0). In Fig. 3b the difference

$$\frac{\Delta\sigma}{\sigma_0} = \frac{\sigma_{max}}{\sigma_0} - \left(1 - \frac{x}{L}\right)$$

is represented which illustrates the deviations between the analytic solution and simple bending moment considerations.

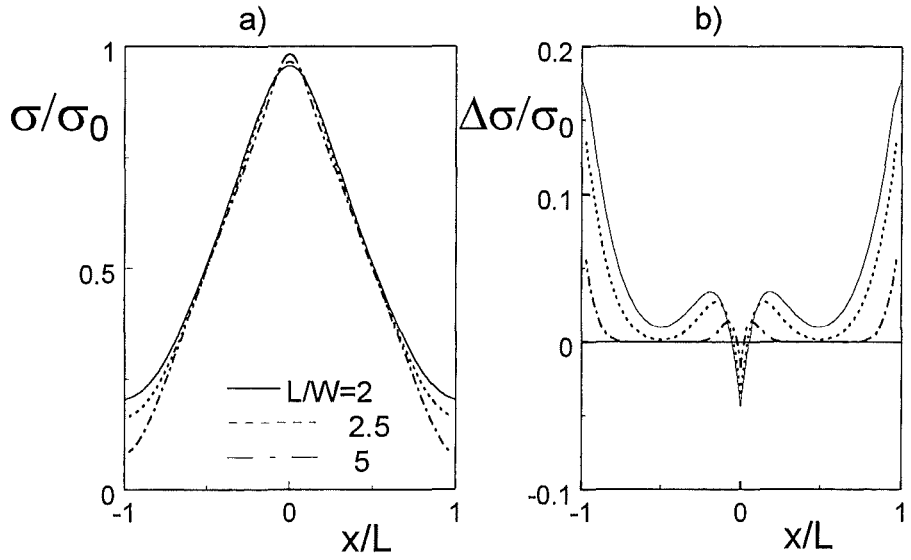

Fig.3 a) Stresses σ_x along the tensile surface (y=-W/2), b) deviation from linear dependency.

2.2 Stresses in a 4-point bending bar

The 4-point bending test (see Fig. 4) can be considered as the superposition of two 3-point bending tests. The stresses simply result in

$$\sigma_{x,4}(d_1/W, d_2/W, x/W) = \sigma_{x,3}(d_1/W, x/W) + \sigma_{x,3}(d_2/W, -x/W) \tag{12}$$

$$\tau_{yx,4}(d_1/W, d_2/W, x/W) = \tau_{xy,3}(d_1/W, x/W) - \tau_{xy,3}(d_2/W, -x/W) \tag{13}$$

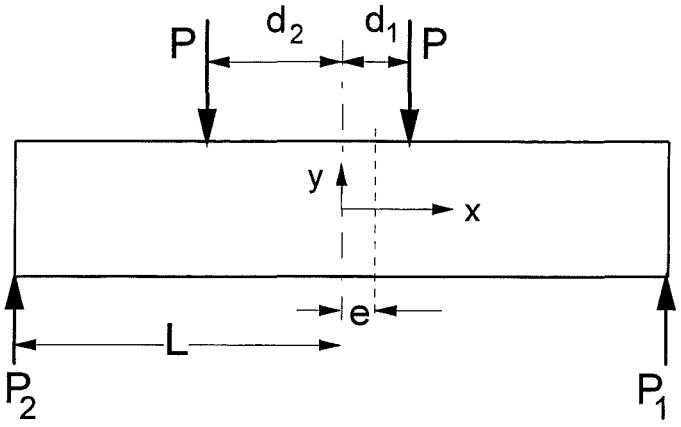

Fig. 4 Four-point bending test (including nonsymmetry).

The stresses along the tensile surfaces of symmetrically loaded bending bars with L/W=2, 2.5, 5 and d_1=d_2=d=$L/2$ are shown in Fig. 5. The stress σ_0 for 4-point loading is

$$\sigma_0 = \frac{6P(L-d)}{W^2 t} \tag{14}$$

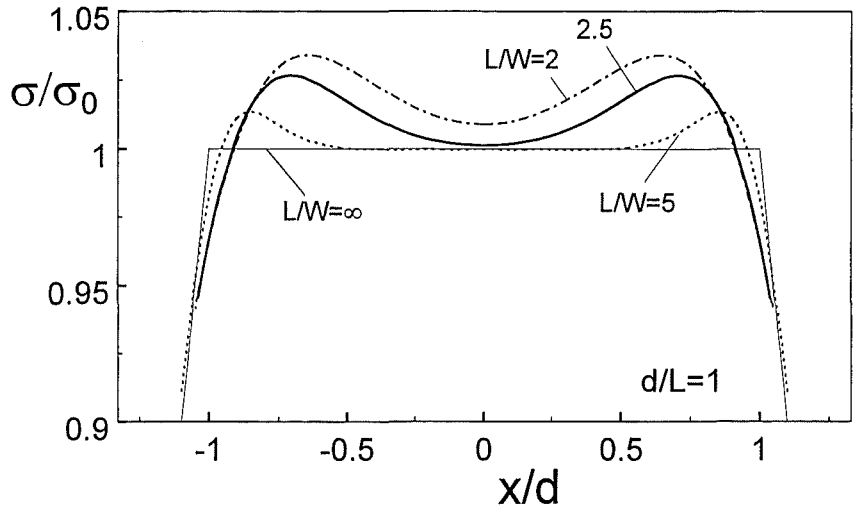

Fig. 5 Stress component σ_x at the tensile surface of a 4-point bending bar for different L/W.

The stresses deviate by some percent from the stresses σ_M computed by the use of the actual bending moment $M(x)$

$$\sigma_M(x) = \frac{M(x)}{\frac{1}{6}W^2 t} \tag{15}$$

This result is represented in Fig. 5 by the curve with $L/W=\infty$. With increasing L/W the stress maxima shift to the location $x=d$.

A comparison of the maximum stresses occurring in 3- and 4-point bending tests is given in Fig. 6 for the most commonly used geometry of the 4-point bending test, $d/L=1/2$. For the plotted data simple linear relations hold, namely,

$$\sigma_{max} / \sigma_0 = 1 - 0.0875 W / L \tag{16}$$

for 3-point bending and

$$\sigma_{max} / \sigma_0 = 1 + 0.0676 W / L \tag{17}$$

for 4-point bending.

Consequently, it may be concluded that (ignoring all statistical effects) strengths determined in 3-point bending tests are higher than strength data measured in 4-point bending.

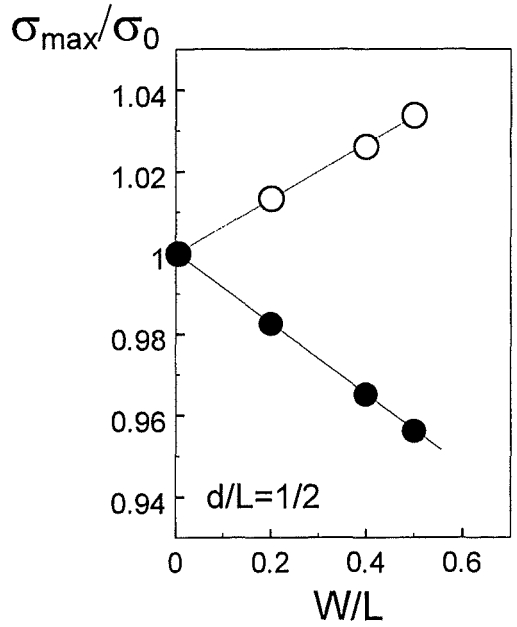

Fig. 6 Comparison of maximum stresses at the tensile surface for 3- and 4-point bending. Open circles: 4-point bending, solid circles: 3-point bending.

3 Stress intensity factors

Based on the normal stresses σ_x and the shear stresses τ_{xy} the stress intensity factors for bending tests with edge cracks can be determined by application of the weight function technique [5]. Figure 7 shows an edge-cracked bar under 3-point bend loading.

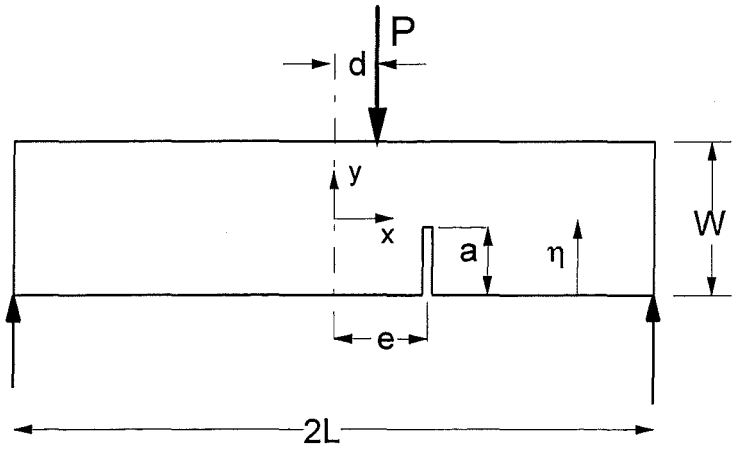

Fig. 7 Edge-cracked bar under 3-point loading.

The crack of depth a is located at $x=e$. The mode-I stress intensity factor K_I results from

$$K_I = \int_0^a h_I(\eta, a)\sigma_x \, d\eta \;, \qquad \eta = y + W/2 \tag{18}$$

where σ_x is the normal stress across the bar at a distance $x=e$ from the middle axis and h_I is the fracture mechanics weight function for mode-I loading (see [6]). The mode-II stress intensity factor K_{II} results from

$$K_{II} = \int_0^a h_{II}(\eta, a)\tau_{xy} \, d\eta \tag{19}$$

with the weight function for mode-II loading. In the following the stress intensity factors are expressed by their geometric functions, which are defined as

$$K_I = \sigma_0 F_I \sqrt{\pi a}\,, \quad \sigma_0 = \frac{3PL}{W^2 t}, \quad F_I = F_I'/(1 - a/W)^{3/2} \tag{20}$$

and

$$K_{II} = \sigma_0 F_{II} \sqrt{\pi a} \tag{21}$$

The weight functions h_I and h_{II} are given in [6]. The mode-I stress intensity factor solutions for L/W=2.5 and 5 are shown in Fig. 8 and the mode-II solutions in Fig. 9 (3-point bending). Results for various geometries are compiled in Section 5 for 3-point bending and in Section 6 for 4-point bending.

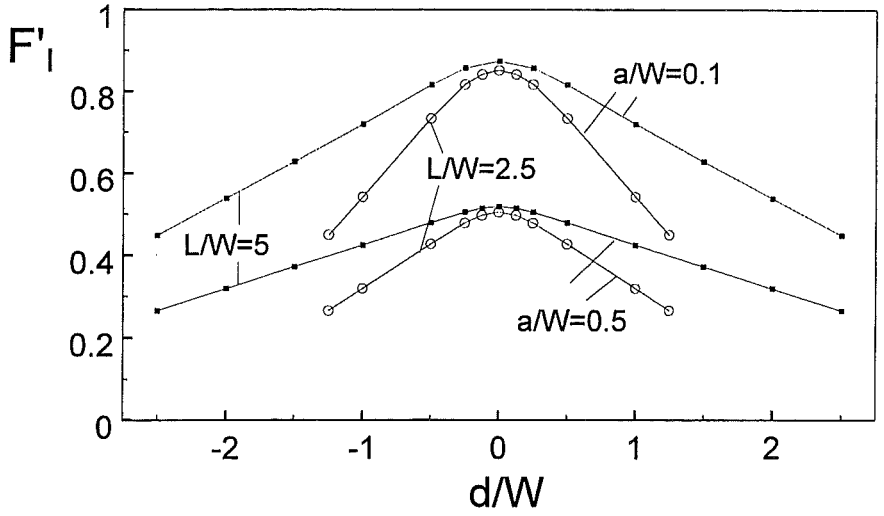

Fig. 8 Geometric function F'_I as a function of eccentricity and crack depth.

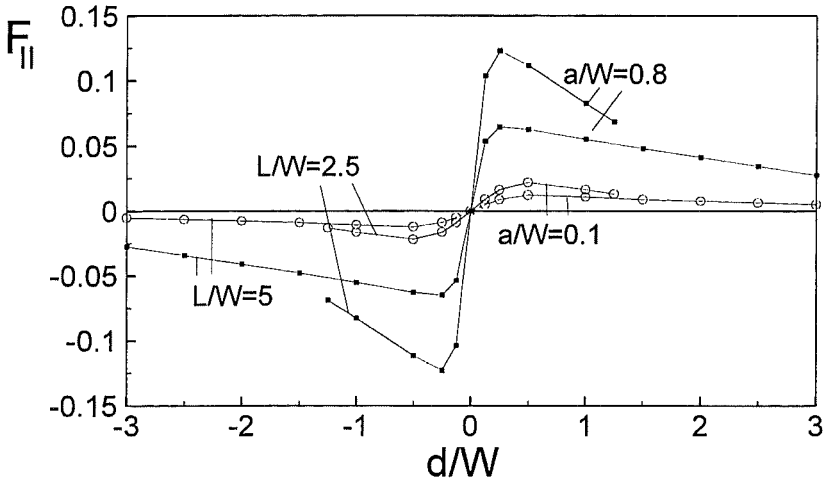

Fig. 9 Geometric function F_{II} as a function of eccentricity and crack depth.

For the crack depth a/W=0.5 the influence of the misalignments e/W and d/W are illustrated in normalised form. In Fig. 10a the geometric functions F'_I are plotted versus e/W-d/W, i.e. versus the relative distance between the crack and the inner load application point. The data points obtained for different L/W-ratios are nearly symmetrical to the axis e/W-d/W =0. In Fig. 10b the data points of Fig. 10a were plotted in the form

$$F'_{e/W-d/W} - F'_{e/W-d/W=0} = f\left(\frac{e/W - d/W}{\sqrt{L/W}}\right). \qquad (22)$$

In this representation all data points can be represented by the same curve. The function f in eq.(22) can be expressed by

$$f\left(\frac{e/W-d/W}{\sqrt{L/W}}\right) \cong -1.075\frac{(e/W-d/W)^2}{L/W}. \tag{23}$$

The geometric function F' can be written as

$$F'(e/W-d/W) = F'_{e/W-d/W=0} - 1.075\frac{(e/W-d/W)^2}{L/W} \tag{24}$$

with

$$F'_{e/W-d/W=0} = \begin{cases} 0.4980 & \text{for } L/W = 2.0 \\ 0.5048 & \text{for } L/W = 2.5 \\ 0.5177 & \text{for } L/W = 5.0 \end{cases}. \tag{25}$$

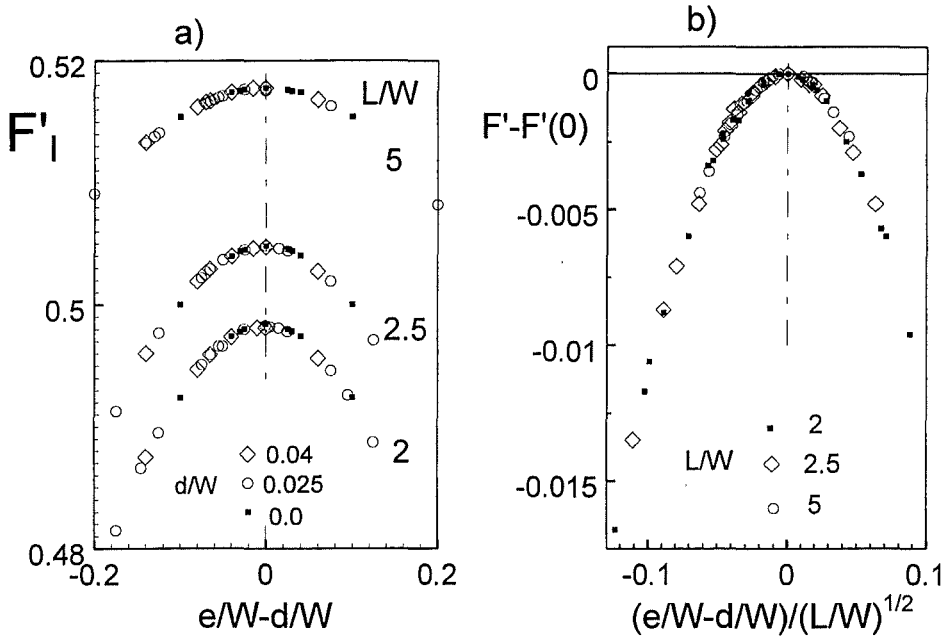

Fig. 10 Influence of e/W and d/W on the mode-I geometric function in normalised representation.

4 References

[1] Baratta, F.I., Requirements for flexure testing of brittle materials, Report of the Army Materials and Mechanics Research Center TR82-20, (1982), Watertown, USA.

[2] Quinn, G.D., Morrell, R., Design data for engineering ceramics: A review of the flexure test, J. Am. Ceram. Soc. **74**(1991), 2037-2066.

[3] Filon, L.N.G., On an approximate solution for the bending of a beam of rectangular cross-section under any system of load, with special reference to points of concentrated or discontinuous loading, Phil. Trans., A, **201**(1903), 63-155.

[4] Timoshenko, S.P., Goodier, J.N., Theory of Elasticity, McGraw-Hill Kogagusha, Ltd., Tokyo.

[5] Bückner, H., A novel principle for the computation of stress intensity factors, ZAMM **50** (1970), 529-546.

[6] Fett, T., Munz, D., Stress intensity factors and weight functions, Computational Mechanics Publications, Southampton, 1997.

5 Geometric functions for 3-point bending

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8500	0.7043	0.6089	0.5445	0.4984	0.4625	0.4327	0.4075
0.025	0.8495	0.7040	0.6086	0.5442	0.4980	0.4620	0.4321	0.4067
0.030	0.8493	0.7038	0.6084	0.5440	0.4978	0.4618	0.4319	0.4064
0.040	0.8488	0.7033	0.6080	0.5436	0.4974	0.4614	0.4313	0.4056
0.100	0.8425	0.6982	0.6033	0.5389	0.4924	0.4557	0.4246	0.3971
0.300	0.7882	0.6536	0.5632	0.5003	0.4536	0.4157	0.3832	0.3553
0.500	0.7013	0.5827	0.5014	0.4439	0.4009	0.3663	0.3373	0.3131
1.000	0.4624	0.3860	0.3327	0.2946	0.2661	0.2434	0.2245	0.2087
-0.025	0.8495	0.7040	0.6086	0.5442	0.4980	0.4620	0.4321	0.4067
-0.030	0.8493	0.7038	0.6084	0.5440	0.4978	0.4618	0.4319	0.4064
-0.040	0.8488	0.7033	0.6080	0.5436	0.4974	0.4614	0.4313	0.4056
-0.100	0.8425	0.6982	0.6033	0.5389	0.4924	0.4557	0.4246	0.3971
-0.300	0.7882	0.6536	0.5632	0.5003	0.4536	0.4157	0.3832	0.3553
-0.500	0.7013	0.5827	0.5014	0.4439	0.4009	0.3663	0.3373	0.3131
-1.000	0.4624	0.3860	0.3327	0.2946	0.2661	0.2434	0.2245	0.2087

Table 5.1 Geometric function F'_{I} for d/W=0.00, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0	0	0	0	0	0	0	0
0.025	-0.0027	-0.0048	-0.0067	-0.0086	-0.0110	-0.0147	-0.0213	-0.0366
0.030	-0.0032	-0.0058	-0.0080	-0.0103	-0.0132	-0.0176	-0.0255	-0.0436
0.040	-0.0043	-0.0077	-0.0107	-0.0137	-0.0176	-0.0233	-0.0337	-0.0573
0.100	-0.0105	-0.0188	-0.0261	-0.0335	-0.0425	-0.0556	-0.0777	-0.1212
0.300	-0.0267	-0.0477	-0.0653	-0.0816	-0.0984	-0.1177	-0.1416	-0.1733
0.500	-0.0336	-0.0603	-0.0818	-0.0999	-0.1159	-0.1314	-0.1488	-0.1739
1.000	-0.0314	-0.0578	-0.0798	-0.0980	-0.1137	-0.1287	-0.1460	-0.1719
-0.025	0.0027	0.0048	0.0067	0.0086	0.0110	0.0147	0.0213	0.0366
-0.030	0.0032	0.0058	0.0080	0.0103	0.0132	0.0176	0.0255	0.0436
-0.040	0.0043	0.0077	0.0107	0.0137	0.0176	0.0233	0.0337	0.0573
-0.100	0.0105	0.0188	0.0261	0.0335	0.0425	0.0556	0.0777	0.1212
-0.300	0.0267	0.0477	0.0653	0.0816	0.0984	0.1177	0.1416	0.1733
-0.500	0.0336	0.0603	0.0818	0.0999	0.1159	0.1314	0.1488	0.1739
-1.000	0.0314	0.0578	0.0798	0.0980	0.1137	0.1287	0.1460	0.1719

Table 5.2 Geometric function F_{II} for d/W=0.00, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8495	0.7040	0.6086	0.5442	0.4980	0.4620	0.4321	0.4067
0.025	0.8498	0.7042	0.6088	0.5444	0.4983	0.4624	0.4326	0.4074
0.030	0.8498	0.7042	0.6088	0.5444	0.4982	0.4624	0.4326	0.4074
0.040	0.8496	0.7040	0.6086	0.5443	0.4981	0.4622	0.4324	0.4071
0.050	0.8492	0.7037	0.6084	0.5440	0.4978	0.4619	0.4320	0.4066
0.100	0.8452	0.7004	0.6053	0.5410	0.4946	0.4583	0.4277	0.4010
0.120	0.8425	0.6982	0.6033	0.5390	0.4926	0.4560	0.4250	0.3976
0.150	0.8375	0.6941	0.5996	0.5353	0.4887	0.4517	0.4201	0.3919
0.300	0.7957	0.6596	0.5686	0.5055	0.4586	0.4208	0.3881	0.3598
-0.025	0.8482	0.7029	0.6076	0.5432	0.4969	0.4608	0.4306	0.4046
-0.030	0.8479	0.7026	0.6073	0.5429	0.4966	0.4605	0.4302	0.4041
-0.040	0.8470	0.7019	0.6067	0.5423	0.4959	0.4597	0.4292	0.4028
-0.050	0.8460	0.7011	0.6059	0.5415	0.4951	0.4588	0.4281	0.4014
-0.100	0.8389	0.6952	0.6006	0.5362	0.4895	0.4525	0.4208	0.3926
-0.120	0.8352	0.6921	0.5977	0.5334	0.4866	0.4493	0.4173	0.3886
-0.150	0.8285	0.6866	0.5927	0.5285	0.4815	0.4439	0.4114	0.3824
-0.300	0.7803	0.6471	0.5575	0.4949	0.4483	0.4106	0.3783	0.3507

Table 5.3 Geometric function F'_{I} for d/W=0.025, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0023	0.0041	0.0057	0.0074	0.0096	0.0131	0.0195	0.0344
0.025	-0.0004	-0.0007	-0.0010	-0.0012	-0.0014	-0.0016	-0.0018	-0.0021
0.030	-0.0009	-0.0017	-0.0023	-0.0030	-0.0036	-0.0046	-0.0061	-0.0096
0.040	-0.0020	-0.0036	-0.0050	-0.0064	-0.0081	-0.0104	-0.0146	-0.0243
0.050	-0.0031	-0.0055	-0.0077	-0.0098	-0.0125	-0.0163	-0.0231	-0.0387
0.100	-0.0084	-0.0150	-0.0208	-0.0267	-0.0339	-0.0443	-0.0625	-0.1008
0.120	-0.0104	-0.0186	-0.0258	-0.0332	-0.0420	-0.0547	-0.0763	-0.1194
0.150	-0.0134	-0.0239	-0.0332	-0.0424	-0.0535	-0.0690	-0.0942	-0.1403
0.300	-0.0256	-0.0457	-0.0627	-0.0786	-0.0954	-0.1152	-0.1405	-0.1745
-0.025	0.0050	0.0088	0.0123	0.0159	0.0205	0.0274	0.0399	0.0680
-0.030	0.0055	0.0098	0.0136	0.0176	0.0226	0.0302	0.0439	0.0742
-0.040	0.0065	0.0117	0.0162	0.0209	0.0269	0.0357	0.0515	0.0858
-0.050	0.0076	0.0135	0.0188	0.0242	0.0310	0.0411	0.0589	0.0965
-0.100	0.0126	0.0225	0.0312	0.0400	0.0506	0.0658	0.0906	0.1360
-0.120	0.0145	0.0259	0.0358	0.0459	0.0578	0.0744	0.1007	0.1461
-0.150	0.0172	0.0307	0.0425	0.0541	0.0676	0.0858	0.1132	0.1566
-0.300	0.0277	0.0494	0.0676	0.0841	0.1008	0.1195	0.1420	0.1718

Table 5.4 Geometric function F_{II} for d/W=0.025, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8493	0.7038	0.6084	0.5440	0.4978	0.4618	0.4319	0.4064
0.025	0.8498	0.7042	0.6088	0.5444	0.4982	0.4624	0.4326	0.4074
0.030	0.8498	0.7042	0.6088	0.5444	0.4982	0.4624	0.4326	0.4074
0.040	0.8496	0.7041	0.6087	0.5443	0.4981	0.4623	0.4324	0.4072
0.100	0.8456	0.7007	0.6056	0.5413	0.4950	0.4587	0.4282	0.4017
0.300	0.7971	0.6608	0.5696	0.5064	0.4596	0.4218	0.3891	0.3607
-0.025	0.8479	0.7026	0.6073	0.5429	0.4966	0.4605	0.4302	0.4041
-0.030	0.8475	0.7023	0.6070	0.5426	0.4963	0.4601	0.4297	0.4035
-0.040	0.8466	0.7015	0.6063	0.5419	0.4955	0.4593	0.4287	0.4021
-0.100	0.8381	0.6946	0.6000	0.5356	0.4888	0.4518	0.4200	0.3917
-0.300	0.7787	0.6458	0.5563	0.4938	0.4472	0.4096	0.3773	0.3498

Table 5.5 Geometric function F'_{I} for d/W=0.030, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0028	0.0049	0.0068	0.0089	0.0115	0.0156	0.0233	0.0411
0.025	0.0001	0.0001	0.0001	0.0003	0.0005	0.0010	0.0021	0.0048
0.030	-0.0005	-0.0009	-0.0012	-0.0015	-0.0017	-0.0019	-0.0022	-0.0026
0.040	-0.0016	-0.0028	-0.0039	-0.0049	-0.0061	-0.0078	-0.0107	-0.0174
0.100	-0.0079	-0.0142	-0.0197	-0.0253	-0.0321	-0.0420	-0.0593	-0.0960
0.300	-0.0253	-0.0453	-0.0621	-0.0780	-0.0947	-0.1146	-0.1401	-0.1747
-0.025	0.0054	0.0096	0.0134	0.0174	0.0223	0.0299	0.0435	0.0738
-0.030	0.0059	0.0106	0.0147	0.0190	0.0245	0.0327	0.0474	0.0797
-0.040	0.0070	0.0125	0.0173	0.0224	0.0287	0.0381	0.0549	0.0909
-0.100	0.0130	0.0232	0.0322	0.0412	0.0522	0.0677	0.0929	0.1384
-0.300	0.0278	0.0497	0.0680	0.0845	0.1012	0.1198	0.1420	0.1714

Table 5.6 Geometric function F_{II} for d/W=0.030, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8488	0.7033	0.6080	0.5436	0.4974	0.4614	0.4313	0.4056
0.025	0.8496	0.7040	0.6086	0.5443	0.4981	0.4622	0.4324	0.4071
0.030	0.8496	0.7041	0.6087	0.5443	0.4981	0.4623	0.4324	0.4072
0.040	0.8496	0.7040	0.6087	0.5443	0.4981	0.4623	0.4325	0.4073
0.100	0.8463	0.7013	0.6062	0.5419	0.4956	0.4595	0.4292	0.4029
0.300	0.7998	0.6630	0.5716	0.5084	0.4616	0.4237	0.3910	0.3626
-0.025	0.8470	0.7019	0.6067	0.5423	0.4959	0.4597	0.4292	0.4028
-0.030	0.8466	0.7015	0.6063	0.5419	0.4955	0.4592	0.4287	0.4021
-0.040	0.8455	0.7007	0.6056	0.5411	0.4947	0.4583	0.4276	0.4006
-0.100	0.8364	0.6932	0.5987	0.5343	0.4875	0.4503	0.4183	0.3897
-0.300	0.7753	0.6431	0.5539	0.4916	0.4451	0.4075	0.3754	0.3480

Table 5.7 Geometric function F'_{I} for; d/W=0.040, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0037	0.0065	0.0091	0.0118	0.0153	0.0208	0.0308	0.0538
0.025	0.0010	0.0017	0.0024	0.0032	0.0044	0.0063	0.0099	0.0187
0.030	0.0004	0.0008	0.0011	0.0015	0.0022	0.0033	0.0056	0.0114
0.040	-0.0006	-0.0012	-0.0016	-0.0020	-0.0023	-0.0026	-0.0029	-0.0034
0.100	-0.0070	-0.0126	-0.0175	-0.0225	-0.0284	-0.0372	-0.0525	-0.0857
0.300	-0.0248	-0.0444	-0.0610	-0.0766	-0.0932	-0.1133	-0.1394	-0.1749
-0.025	0.0063	0.0112	0.0156	0.0202	0.0260	0.0348	0.0504	0.0845
-0.030	0.0068	0.0122	0.0169	0.0219	0.0281	0.0375	0.0542	0.0900
-0.040	0.0079	0.0140	0.0195	0.0251	0.0322	0.0428	0.0614	0.1002
-0.100	0.0138	0.0246	0.0341	0.0437	0.0552	0.0713	0.0972	0.1425
-0.300	0.0282	0.0503	0.0687	0.0854	0.1020	0.1202	0.1420	0.1707

Table 5.8 Geometric function F_{II} for d/W=0.040, L/W=2.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8617	0.7156	0.6189	0.5528	0.5048	0.4673	0.4359	0.4095
0.025	0.8613	0.7153	0.6186	0.5525	0.5045	0.4669	0.4355	0.4089
0.030	0.8611	0.7152	0.6184	0.5524	0.5044	0.4668	0.4353	0.4086
0.040	0.8607	0.7148	0.6181	0.5520	0.5040	0.4664	0.4348	0.4079
0.100	0.8557	0.7107	0.6143	0.5483	0.5000	0.4619	0.4295	0.4011
0.300	0.8123	0.6750	0.5822	0.5174	0.4690	0.4299	0.3964	0.3677
-0.025	0.8613	0.7153	0.6186	0.5525	0.5045	0.4669	0.4355	0.4089
-0.030	0.8611	0.7152	0.6184	0.5524	0.5044	0.4668	0.4353	0.4086
-0.040	0.8607	0.7148	0.6181	0.5520	0.5040	0.4664	0.4348	0.4079
-0.100	0.8557	0.7107	0.6143	0.5483	0.5000	0.4619	0.4295	0.4011
-0.300	0.8123	0.6750	0.5822	0.5174	0.4690	0.4299	0.3964	0.3677

Table 5.9 Geometric function F'_{I} for d/W=0.00, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0	0	0	0	0	0	0	0
0.025	-0.0022	-0.0038	-0.0053	-0.0069	-0.0088	-0.0117	-0.0170	-0.0293
0.030	-0.0026	-0.0046	-0.0064	-0.0083	-0.0106	-0.0141	-0.0204	-0.0349
0.040	-0.0034	-0.0061	-0.0085	-0.0110	-0.0141	-0.0187	-0.0270	-0.0458
0.100	-0.0084	-0.0151	-0.0209	-0.0268	-0.0340	-0.0445	-0.0621	-0.0970
0.300	-0.0214	-0.0382	-0.0523	-0.0653	-0.0788	-0.0942	-0.1133	-0.1387
-0.025	0.0022	0.0038	0.0053	0.0069	0.0088	0.0117	0.0170	0.0293
-0.030	0.0026	0.0046	0.0064	0.0083	0.0106	0.0141	0.0204	0.0349
-0.040	0.0034	0.0061	0.0085	0.0110	0.0141	0.0187	0.0270	0.0458
-0.100	0.0084	0.0151	0.0209	0.0268	0.0340	0.0445	0.0621	0.0970
-0.300	0.0214	0.0382	0.0523	0.0653	0.0788	0.0942	0.1133	0.1387

Table 5.10 Geometric function F_{II} for d/W=0.00, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8613	0.7153	0.6186	0.5525	0.5045	0.4669	0.4355	0.4089
0.025	0.8615	0.7155	0.6188	0.5527	0.5048	0.4672	0.4359	0.4094
0.030	0.8615	0.7155	0.6188	0.5527	0.5048	0.4672	0.4359	0.4094
0.040	0.8614	0.7154	0.6186	0.5526	0.5046	0.4671	0.4357	0.4092
0.050	0.8611	0.7152	0.6184	0.5524	0.5044	0.4668	0.4354	0.4088
0.100	0.8579	0.7125	0.6160	0.5500	0.5019	0.4640	0.4320	0.4043
0.150	0.8518	0.7075	0.6114	0.5454	0.4971	0.4588	0.4260	0.3971
0.300	0.8185	0.6800	0.5867	0.5217	0.4732	0.4341	0.4004	0.3715
-0.025	0.8602	0.7145	0.6178	0.5517	0.5037	0.4659	0.4343	0.4072
-0.030	0.8599	0.7142	0.6176	0.5515	0.5034	0.4656	0.4339	0.4067
-0.040	0.8593	0.7136	0.6170	0.5509	0.5029	0.4650	0.4332	0.4057
-0.050	0.8585	0.7130	0.6164	0.5503	0.5022	0.4643	0.4323	0.4046
-0.100	0.8527	0.7083	0.6121	0.5460	0.4977	0.4592	0.4264	0.3975
-0.150	0.8443	0.7013	0.6058	0.5398	0.4913	0.4523	0.4189	0.1256
-0.300	0.8056	0.6696	0.5775	0.5129	0.4646	0.4256	0.3923	0.3639

Table 5.11 Geometric function F'_{I} for d/W=0.025, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0019	0.0034	0.0047	0.0061	0.0079	0.0107	0.0159	0.0279
0.025	-0.0003	-0.0005	-0.0006	-0.0008	-0.0009	-0.0010	-0.0012	-0.0014
0.030	-0.0007	-0.0012	-0.0017	-0.0022	-0.0027	-0.0034	-0.0046	-0.0073
0.040	-0.0015	-0.0028	-0.0038	-0.0049	-0.0062	-0.0081	-0.0114	-0.0191
0.050	-0.0024	-0.0043	-0.0060	-0.0077	-0.0097	-0.0128	-0.0182	-0.0306
0.100	-0.0066	-0.0119	-0.0165	-0.0212	-0.0269	-0.0352	-0.0352	-0.0497
0.150	-0.0107	-0.0190	-0.0264	-0.0338	-0.0426	-0.0549	-0.0751	-0.1119
0.300	-0.0204	-0.0365	-0.0501	-0.0627	-0.0761	-0.0919	-0.1121	-0.1393
-0.025	0.0040	0.0072	0.0100	0.0129	0.0166	0.0222	0.0322	0.0548
-0.030	0.0045	0.0079	0.0110	0.0143	0.0183	0.0244	0.0354	0.0597
-0.040	0.0053	0.0094	0.0131	0.0170	0.0217	0.0288	0.0415	0.0690
-0.050	0.0061	0.0109	0.0152	0.0196	0.0251	0.0332	0.0474	0.0776
-0.100	0.0101	0.0181	0.0251	0.0322	0.0408	0.0529	0.0727	0.1092
-0.150	0.0138	0.0247	0.0341	0.0435	0.0543	0.0689	0.0908	0.3893
-0.300	0.0222	0.0397	0.0543	0.0675	0.0809	0.0959	0.1139	0.1377

Table 5.12 Geometric function F_{II} for mode-II stress intensity factor; d/W=0.025, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8611	0.7152	0.6184	0.5524	0.5044	0.4668	0.4353	0.4086
0.025	0.8615	0.7155	0.6188	0.5527	0.5048	0.4672	0.4359	0.4094
0.030	0.8615	0.7155	0.6188	0.5527	0.5048	0.4672	0.4359	0.4094
0.040	0.8614	0.7154	0.6187	0.5526	0.5047	0.4671	0.4358	0.4093
0.100	0.8583	0.7128	0.6163	0.5503	0.5022	0.4643	0.4325	0.4049
0.300	0.8196	0.6810	0.5876	0.5225	0.4740	0.4349	0.4012	0.3722
-0.025	0.8599	0.7142	0.6176	0.5515	0.5034	0.4656	0.4339	0.4067
-0.030	0.8596	0.7139	0.6173	0.5512	0.5032	0.4653	0.4336	0.4062
-0.040	0.8589	0.7133	0.6168	0.5506	0.5026	0.4647	0.4328	0.4051
-0.100	0.8521	0.7077	0.6116	0.5455	0.4971	0.4587	0.4258	0.3967
-0.300	0.8043	0.6685	0.5765	0.5120	0.4637	0.4248	0.3915	0.3632

Table 5.13 Geometric function F'_{I} for d/W=0.030, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0023	0.0041	0.0056	0.0073	0.0095	0.0128	0.0190	0.0333
0.025	0.0001	0.0002	0.0003	0.0004	0.0007	0.0011	0.0020	0.0043
0.030	-0.0003	-0.0006	-0.0008	-0.0009	-0.0011	-0.0012	-0.0014	-0.0016
0.040	-0.0012	-0.0021	-0.0029	-0.0037	-0.0046	-0.0059	-0.0082	-0.0135
0.100	-0.0063	-0.0112	-0.0156	-0.0200	-0.0254	-0.0333	-0.0471	-0.0764
0.300	-0.0202	-0.0361	-0.0496	-0.0622	-0.0755	-0.0914	-0.1118	-0.1393
-0.025	0.0044	0.0079	0.0109	0.0141	0.0181	0.0242	0.0351	0.0594
-0.030	0.0048	0.0086	0.0120	0.0155	0.0199	0.0264	0.0382	0.0642
-0.040	0.0057	0.0101	0.0140	0.0181	0.0232	0.0308	0.0443	0.0731
-0.100	0.0105	0.0187	0.0259	0.0332	0.0420	0.0545	0.0746	0.1111
-0.300	0.0224	0.0400	0.0546	0.0679	0.0813	0.0961	0.1140	0.1375

Table 5.14 Geometric function F_{II} for d/W=0.030, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8607	0.7148	0.6181	0.5520	0.5040	0.4664	0.4348	0.4079
0.025	0.8614	0.7154	0.6186	0.5526	0.5046	0.4671	0.4357	0.4092
0.030	0.8614	0.7154	0.6186	0.5526	0.5046	0.4671	0.4358	0.4093
0.040	0.8614	0.7154	0.6187	0.5526	0.5047	0.4671	0.4358	0.4094
0.100	0.8589	0.7133	0.6168	0.5507	0.5027	0.4650	0.4332	0.4059
0.300	0.8220	0.6829	0.5893	0.5241	0.4756	0.4365	0.4028	0.3737
-0.025	0.8592	0.7136	0.6170	0.5509	0.5029	0.4650	0.4332	0.4057
-0.030	0.8589	0.7133	0.6168	0.5506	0.5026	0.4647	0.4328	0.4051
-0.040	0.8580	0.7126	0.6161	0.5500	0.5019	0.4639	0.4318	0.4040
-0.100	0.8507	0.7066	0.6105	0.5445	0.4960	0.4574	0.4244	0.3952
-0.300	0.8015	0.6662	0.5745	0.5101	0.4620	0.4231	0.3899	0.3617

Table 5.15 Geometric function F'_{I} for d/W=0.040, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0030	0.0054	0.0075	0.0097	0.0126	0.0170	0.0251	0.0436
0.025	0.0009	0.0016	0.0022	0.0029	0.0039	0.0054	0.0084	0.0155
0.030	0.0005	0.0008	0.0011	0.0015	0.0021	0.0031	0.0050	0.0097
0.040	-0.0004	-0.0007	-0.0010	-0.0013	-0.0015	-0.0016	-0.0019	-0.0022
0.100	-0.0055	-0.0099	-0.0138	-0.0177	-0.0224	-0.0293	-0.0415	-0.0680
0.300	-0.0198	-0.0354	-0.0486	-0.0610	-0.0743	-0.0902	-0.1110	-0.1394
-0.025	0.0051	0.0092	0.0127	0.0165	0.0212	0.0282	0.0408	0.0682
-0.030	0.0056	0.0099	0.0138	0.0178	0.0229	0.0304	0.0438	0.0726
-0.040	0.0064	0.0114	0.0158	0.0204	0.0262	0.0347	0.0496	0.0807
-0.100	0.0111	0.0199	0.0275	0.0353	0.0445	0.0575	0.0782	0.1146
-0.300	0.0227	0.0405	0.0553	0.0687	0.0820	0.0966	0.1141	0.1371

Table 5.16 Geometric function F_{II} for d/W=0.040, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8557	0.7107	0.6143	0.5483	0.5000	0.4619	0.4295	0.4011
0.025	0.8579	0.7125	0.6160	0.5500	0.5019	0.4640	0.4320	0.4043
0.030	0.8583	0.7128	0.6163	0.5503	0.5022	0.4643	0.4325	0.4049
0.040	0.8589	0.7133	0.6168	0.5507	0.5027	0.4650	0.4332	0.4059
0.100	0.8602	0.7144	0.6178	0.5518	0.5040	0.4665	0.4352	0.4088
0.300	0.8342	0.6929	0.5983	0.5329	0.4846	0.4457	0.4122	0.3828
-0.025	0.8527	0.7083	0.6121	0.5460	0.4977	0.4592	0.4264	0.3975
-0.030	0.8521	0.7077	0.6116	0.5455	0.4971	0.4587	0.4258	0.3967
-0.040	0.8507	0.7066	0.6105	0.5445	0.4960	0.4574	0.4244	0.3952
-0.100	0.8400	0.6978	0.6026	0.5366	0.4879	0.4488	0.4151	0.3855
-0.300	0.7838	0.6518	0.5619	0.4985	0.4509	0.4126	0.3801	0.3528

Table 5.17 Geometric function F'_{I} for d/W=0.10, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0074	0.0132	0.0183	0.0237	0.0304	0.0404	0.0575	0.0915
0.025	0.0054	0.0095	0.0133	0.0172	0.0223	0.0301	0.0439	0.0734
0.030	0.0050	0.0088	0.0122	0.0159	0.0207	0.0279	0.0410	0.0693
0.040	0.0041	0.0073	0.0102	0.0133	0.0173	0.0236	0.0350	0.0603
0.100	-0.0010	-0.0019	-0.0026	-0.0031	-0.0036	-0.0041	-0.0047	-0.0055
0.300	-0.0168	-0.0301	-0.0414	-0.0525	-0.0648	-0.0806	-0.1032	-0.1371
-0.025	0.0094	0.0167	0.0232	0.0298	0.0380	0.0498	0.0692	0.1050
-0.030	0.0098	0.0174	0.0241	0.0310	0.0395	0.0516	0.0714	0.1073
-0.040	0.0105	0.0188	0.0260	0.0334	0.0423	0.0550	0.0754	0.1113
-0.100	0.0148	0.0263	0.0363	0.0462	0.0575	0.0724	0.0939	0.1261
-0.300	0.0240	0.0429	0.0584	0.0719	0.0848	0.0981	0.1134	0.1340

Table 5.18 Geometric function F_{II} for d/W=0.100, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8848	0.7381	0.6387	0.5692	0.5177	0.4768	0.4425	0.4134
0.025	0.8846	0.7379	0.6385	0.5690	0.5176	0.4767	0.4423	0.4131
0.030	0.8846	0.7379	0.6384	0.5690	0.5175	0.4766	0.4422	0.4130
0.040	0.8844	0.7377	0.6383	0.5688	0.5174	0.4764	0.4419	0.4126
0.100	0.8819	0.7356	0.6364	0.5669	0.5154	0.4742	0.4393	0.4092
0.300	0.8602	0.7178	0.6203	0.5515	0.4998	0.4582	0.4227	0.3925
-0.025	0.8846	0.7379	0.6385	0.5690	0.5176	0.4767	0.4423	0.4131
-0.030	0.8846	0.7379	0.6384	0.5690	0.5175	0.4766	0.4422	0.4130
-0.040	0.8844	0.7377	0.6383	0.5688	0.5174	0.4764	0.4419	0.4126
-0.100	0.8819	0.7356	0.6364	0.5669	0.5154	0.4742	0.4393	0.4092
-0.300	0.8602	0.7178	0.6203	0.5515	0.4998	0.4582	0.4227	0.3925

Table 5.19 Geometric function F_{I} for d/W=0, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0	0	0	0	0	0	0	0
0.025	-0.0011	-0.0019	-0.0027	-0.0035	-0.0044	-0.0059	-0.0085	-0.0146
0.030	-0.0013	-0.0023	-0.0032	-0.0041	-0.0053	-0.0070	-0.0102	-0.0175
0.040	-0.0017	-0.0031	-0.0043	-0.0055	-0.0070	-0.0093	-0.0135	-0.0229
0.100	-0.0042	-0.0075	-0.0104	-0.0134	-0.0170	-0.0222	-0.0311	-0.0485
0.300	-0.0107	-0.0191	-0.0262	-0.0327	-0.0394	-0.0471	-0.0567	-0.0693
-0.025	0.0011	0.0019	0.0027	0.0035	0.0044	0.0059	0.0085	0.0146
-0.030	0.0013	0.0023	0.0032	0.0041	0.0053	0.0070	0.0102	0.0175
-0.040	0.0017	0.0031	0.0043	0.0055	0.0070	0.0093	0.0135	0.0229
-0.100	0.0042	0.0075	0.0104	0.0134	0.0170	0.0222	0.0311	0.0485
-0.300	0.0107	0.0191	0.0262	0.0327	0.0394	0.0471	0.0567	0.0693

Table 5.20 Geometric function F_{II} for d/W=0, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8847	0.7379	0.6385	0.5690	0.5176	0.4767	0.4423	0.4131
0.025	0.8848	0.7381	0.6386	0.5692	0.5177	0.4768	0.4425	0.4134
0.030	0.8848	0.7380	0.6386	0.5692	0.5177	0.4768	0.4425	0.4134
0.040	0.8847	0.7380	0.6386	0.5691	0.5177	0.4768	0.4424	0.4133
0.100	0.8831	0.7366	0.6373	0.5678	0.5163	0.4753	0.4406	0.4109
0.300	0.8635	0.7205	0.6228	0.5538	0.5021	0.4604	0.4249	0.3945
-0.025	0.8841	0.7375	0.6381	0.5686	0.5171	0.4762	0.4417	0.4122
-0.030	0.8839	0.7373	0.6380	0.5685	0.5170	0.4760	0.4415	0.4120
-0.040	0.8836	0.7371	0.6377	0.5682	0.5167	0.4757	0.4411	0.4115
-0.100	0.8803	0.7343	0.6352	0.5658	0.5141	0.4728	0.4377	0.4074
-0.300	0.8566	0.7148	0.6178	0.5491	0.4975	0.4559	0.4206	0.3905

Table 5.21 Geometric function F_{I} for d/W=0.025, L/W=5.0.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0010	0.0018	0.0025	0.0033	0.0042	0.0056	0.0082	0.0143
0.025	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003	-0.0003
0.030	-0.0003	-0.0005	-0.0007	-0.0009	-0.0011	-0.0014	-0.0020	-0.0033
0.040	-0.0007	-0.0013	-0.0018	-0.0023	-0.0029	-0.0038	-0.0054	-0.0092
0.100	-0.0033	-0.0058	-0.0081	-0.0104	-0.0132	-0.0174	-0.0246	-0.0398
0.300	-0.0101	-0.0181	-0.0249	-0.0312	-0.0378	-0.0457	-0.0558	-0.0693
-0.025	0.0021	0.0037	0.0052	0.0067	0.0085	0.0114	0.0164	0.0277
-0.030	0.0023	0.0041	0.0057	0.0073	0.0094	0.0125	0.0180	0.0302
-0.040	0.0027	0.0048	0.0067	0.0087	0.0111	0.0147	0.0210	0.0348
-0.100	0.0051	0.0092	0.0127	0.0163	0.0206	0.0267	0.0367	0.0549
-0.300	0.0112	0.0200	0.0273	0.0340	0.0407	0.0482	0.0572	0.0692

Table 5.22 Geometric function F_{II} for d/W=0.025, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8846	0.7379	0.6384	0.5690	0.5175	0.4766	0.4422	0.4130
0.025	0.8848	0.7381	0.6386	0.5692	0.5177	0.4768	0.4425	0.4134
0.030	0.8848	0.7380	0.6386	0.5692	0.5177	0.4768	0.4425	0.4134
0.040	0.8848	0.7380	0.6386	0.5691	0.5177	0.4768	0.4424	0.4133
0.100	0.8833	0.7368	0.6375	0.5680	0.5165	0.4754	0.4408	0.4112
0.300	0.8642	0.7211	0.6233	0.5543	0.5025	0.4608	0.4253	0.3949
-0.025	0.8840	0.7374	0.6380	0.5685	0.5170	0.4760	0.4415	0.4120
-0.030	0.8838	0.7372	0.6378	0.5684	0.5169	0.4759	0.4413	0.4118
-0.040	0.8834	0.7369	0.6376	0.5681	0.5166	0.4755	0.4409	0.4112
-0.100	0.880	0.7340	0.6349	0.5655	0.5138	0.4725	0.4374	0.4070
-0.300	0.8558	0.7142	0.6172	0.5486	0.4970	0.4554	0.4201	0.3901

Table 5.23 Geometric function F_{I} for d/W=0.030, L/W=5.0.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0012	0.0022	0.0030	0.0039	0.0050	0.0067	0.0098	0.0170
0.025	0.0001	0.0002	0.0003	0.0005	0.0006	0.0009	0.0014	0.0026
0.030	-0.0001	-0.0001	-0.0002	-0.0002	-0.0003	-0.0003	-0.0004	-0.0004
0.040	-0.0005	-0.0009	-0.0013	-0.0016	-0.0020	-0.0027	-0.0038	-0.0063
0.100	-0.0031	-0.0055	-0.0076	-0.0098	-0.0124	-0.0163	-0.0232	-0.0378
0.300	-0.0100	-0.0179	-0.0246	-0.0309	-0.0375	-0.0454	-0.0555	-0.0693
-0.025	0.0023	0.0041	0.0057	0.0073	0.0094	0.0124	0.0179	0.0301
-0.030	0.0025	0.0044	0.0062	0.0080	0.0102	0.0135	0.0195	0.0325
-0.040	0.0029	0.0052	0.0072	0.0093	0.0119	0.0157	0.0225	0.0370
-0.100	0.0053	0.0095	0.0123	0.0169	0.0213	0.0275	0.0377	0.0560
-0.300	0.0113	0.0201	0.0275	0.0342	0.0409	0.0484	0.0573	0.0692

Table 5.24 Geometric function F_{II} for d/W=0.030, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8844	0.7377	0.6383	0.5688	0.5174	0.4764	0.4419	0.4126
0.025	0.8847	0.7380	0.6386	0.5691	0.5177	0.4768	0.4424	0.4133
0.030	0.8848	0.7380	0.6386	0.5691	0.5177	0.4768	0.4424	0.4133
0.040	0.8848	0.7380	0.6386	0.5691	0.5177	0.4768	0.4425	0.4134
0.100	0.8836	0.7371	0.6377	0.5683	0.5168	0.4758	0.4412	0.4117
0.300	0.8654	0.7221	0.6242	0.5551	0.5034	0.4617	0.4262	0.3957
-0.025	0.8836	0.7371	0.6377	0.5682	0.5167	0.4757	0.4411	0.4115
-0.030	0.8834	0.7369	0.6376	0.5681	0.5166	0.4755	0.4409	0.4112
-0.040	0.8830	0.7365	0.6372	0.5678	0.5162	0.4751	0.4404	0.4106
-0.100	0.8792	0.7334	0.6344	0.5649	0.5133	0.4718	0.4366	0.4062
-0.300	0.8543	0.7130	0.6161	0.5476	0.4961	0.4545	0.4193	0.3893

Table 5.25 Geometric function F_{I} for d/W=0.040, L/W=5.0.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0016	0.0029	0.0040	0.0052	0.0067	0.0089	0.0130	0.0224
0.025	0.0005	0.0010	0.0013	0.0018	0.0023	0.0031	0.0047	0.0083
0.030	0.0003	0.0006	0.0008	0.0011	0.0014	0.0019	0.0030	0.0054
0.040	-0.0001	-0.0002	-0.0003	-0.0003	-0.0004	-0.0004	-0.0005	-0.0005
0.100	-0.0027	-0.0048	-0.0066	-0.0085	-0.0108	-0.0142	-0.0203	-0.0335
0.300	-0.0098	-0.0175	-0.0240	-0.0302	-0.0368	-0.0447	-0.0550	-0.0692
-0.025	0.0027	0.0048	0.0066	0.0086	0.0110	0.0145	0.0209	0.0346
-0.030	0.0029	0.0051	0.0071	0.0092	0.0118	0.0156	0.0224	0.0368
-0.040	0.0033	0.0059	0.0082	0.0105	0.0134	0.0177	0.0252	0.0409
-0.100	0.0057	0.0101	0.0140	0.0179	0.0226	0.0292	0.0396	0.0578
-0.300	0.0114	0.0204	0.0279	0.0346	0.0413	0.0487	0.0575	0.0691

Table 5.26 Geometric function F_{II} for d/W=0.040, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.8819	0.7356	0.6364	0.5669	0.5154	0.4742	0.4393	0.4092
0.025	0.8831	0.7366	0.6373	0.5678	0.5163	0.4752	0.4406	0.4109
0.030	0.8832	0.7368	0.6375	0.5680	0.5165	0.4754	0.4408	0.4111
0.040	0.8836	0.7371	0.6377	0.5683	0.5168	0.4758	0.4412	0.4117
0.100	0.8845	0.7378	0.6384	0.5690	0.5175	0.4766	0.4423	0.4132
0.300	0.8722	0.7276	0.6292	0.5600	0.5082	0.4666	0.4312	0.4006
-0.025	0.8803	0.7343	0.6352	0.5658	0.5141	0.4728	0.4377	0.4074
-0.030	0.8799	0.7340	0.6349	0.5655	0.5138	0.4725	0.4374	0.4070
-0.040	0.8792	0.7334	0.6344	0.5649	0.5133	0.4718	0.4366	0.4062
-0.100	0.8737	0.7289	0.6302	0.5609	0.5091	0.4674	0.4319	0.4012
-0.300	0.8448	0.7053	0.6094	0.5413	0.4902	0.4489	0.4141	0.3845

Table 5.27 Geometric function F_{I} for d/W=0.100, L/W=5.0.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0040	0.0071	0.0098	0.0126	0.0161	0.0212	0.0299	0.0471
0.025	0.0029	0.0052	0.0073	0.0094	0.0121	0.0161	0.0231	0.0381
0.030	0.0027	0.0049	0.0068	0.0087	0.0112	0.0150	0.0217	0.0360
0.040	0.0023	0.0041	0.0057	0.0074	0.0096	0.0128	0.0187	0.0315
0.100	-0.0003	-0.0005	-0.0006	-0.0008	-0.0009	-0.0010	-0.0012	-0.0014
0.300	-0.0081	-0.0146	-0.0201	-0.0254	-0.0315	-0.0393	-0.0504	-0.0672
-0.025	0.0050	0.0088	0.0122	0.0157	0.0199	0.0259	0.0358	0.0539
-0.030	0.0051	0.0092	0.0127	0.0163	0.0206	0.0268	0.0369	0.0550
-0.040	0.0055	0.0098	0.0136	0.0175	0.0221	0.0285	0.0389	0.0570
-0.100	0.0076	0.0136	0.0188	0.0239	0.0297	0.0372	0.0481	0.0644
-0.300	0.0123	0.0219	0.0298	0.0367	0.0433	0.0501	0.0579	0.0684

Table 5.28 Geometric function F_{II} for d/W=0.100, L/W=5.0

6 Geometric functions for 4-point bending

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9096	0.7617	0.6592	0.5860	0.5308	0.4864	0.4490	0.4173
0.125	0.9100	0.7620	0.6594	0.5861	0.5309	0.4865	0.4490	0.4173
0.250	0.9113	0.7628	0.6599	0.5864	0.5310	0.4865	0.4490	0.4173
0.500	0.9169	0.7663	0.6620	0.5876	0.5317	0.4868	0.4491	0.4173
0.800	0.9247	0.7703	0.6644	0.5895	0.5332	0.4879	0.4496	0.4175
1.000	0.9173	0.7628	0.6585	0.5857	0.5316	0.4879	0.4504	0.4180
1.125	0.8984	0.7465	0.6451	0.5752	0.5241	0.4834	0.4487	0.4182
1.200	0.8794	0.7305	0.6314	0.5636	0.5143	0.4756	0.4432	0.4155
1.250	0.8633	0.7168	0.6196	0.5532	0.5050	0.4673	0.4359	0.4095
1.300	0.8442	0.7008	0.6056	0.5404	0.4932	0.4562	0.4253	0.3988
1.400	0.7980	0.6619	0.5711	0.5086	0.4629	0.4267	0.3956	0.3682
1.500	0.7425	0.6152	0.5294	0.4699	0.4260	0.3908	0.3606	0.3345

Table 6.1 Geometric function F'_I for d_1/W=1.25, d_1/W=1.25, L/W=2.5

For e/W<0 the same geometric function F'_I results as in case of e/W>0.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0	0	0	0	0	0	0	0
0.125	0.0005	0.0008	0.0009	0.0009	0.0007	0.0005	0.0003	0.0001
0.250	0.0011	0.0017	0.0019	0.0018	0.0015	0.0011	0.0006	0.0002
0.500	0.0023	0.0035	0.0039	0.0037	0.0033	0.0025	0.0016	0.0007
0.800	0.0010	0.0005	-0.0002	-0.0003	0.0003	0.0013	0.0021	0.0019
1.000	-0.0063	-0.0125	-0.0174	-0.0199	-0.0195	-0.0158	-0.0088	-0.0008
1.125	-0.0145	-0.0272	-0.0374	-0.0447	-0.0486	-0.0485	-0.0426	-0.0269
1.200	-0.0204	-0.0378	-0.0521	-0.0636	-0.0725	-0.0790	-0.0830	-0.0812
1.250	-0.0245	-0.0451	-0.0624	-0.0770	-0.0897	-0.1021	-0.1163	-0.1374
1.300	-0.0285	-0.0524	-0.0726	-0.0903	-0.1070	-0.1251	-0.1496	-0.1935
1.400	-0.0359	-0.0657	-0.0913	-0.1144	-0.1374	-0.1638	-0.1997	-0.2575
1.500	-0.0415	-0.0760	-0.1057	-0.1325	-0.1588	-0.1876	-0.2234	-0.2737

Table 6.2 Geometric function F_{II} for d_1/W=1.25, d_1/W=1.25, L/W=2.5

For e/W<0 the geometric function F_{II} is the same as in Table 6.2 but with a changed sign.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9096	0.7617	0.6592	0.5860	0.5308	0.4864	0.4490	0.4173
0.125	0.9111	0.7629	0.6601	0.5867	0.5314	0.4870	0.4495	0.4178
0.250	0.9135	0.7646	0.6613	0.5876	0.5321	0.4875	0.4500	0.4182
0.500	0.9213	0.7698	0.6649	0.5901	0.5339	0.4888	0.4509	0.4190
0.800	0.9305	0.7750	0.6685	0.5932	0.5366	0.4911	0.4526	0.4202
1.000	0.9219	0.7665	0.6618	0.5890	0.5350	0.4914	0.4540	0.4214
-0.125	0.9090	0.7611	0.6586	0.5855	0.5303	0.4860	0.4486	0.4169
-0.250	0.9092	0.7611	0.6584	0.5851	0.5299	0.4855	0.4482	0.4165
-0.500	0.9125	0.7628	0.6591	0.5851	0.5294	0.4848	0.4473	0.4157
-0.800	0.9186	0.7655	0.6603	0.5857	0.5297	0.4846	0.4467	0.4148
-1.000	0.9123	0.7587	0.6548	0.5822	0.5280	0.4842	0.4468	0.4145

Table 6.3 Geometric function F'_{I} for d_1/W=1.225, d_1/W=1.275, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0006	0.0011	0.0015	0.0017	0.0020	0.0022	0.0024	0.0028
0.125	0.0011	0.0019	0.0024	0.0026	0.0027	0.0027	0.0027	0.0029
0.250	0.0017	0.0028	0.0034	0.0036	0.0035	0.0033	0.0030	0.0030
0.500	0.0029	0.0045	0.0052	0.0054	0.0052	0.0047	0.0040	0.0035
0.800	0.0009	0.0004	-0.0001	-0.0001	0.0009	0.0025	0.0042	0.0047
1.000	-0.0072	-0.0142	-0.0196	-0.0225	-0.0224	-0.0185	-0.0105	-0.0001
-0.125	0.0001	0.0003	0.0005	0.0009	0.0013	0.0017	0.0021	0.0027
-0.250	-0.0004	-0.0006	-0.0004	-0.0001	0.0005	0.0011	0.0018	0.0026
-0.500	-0.0017	-0.0024	-0.0024	-0.0020	-0.0013	-0.0003	0.0009	0.0021
-0.800	-0.0009	-0.0004	0.0004	0.0008	0.0006	0.0001	0.0000	0.0010
-1.000	0.0054	0.0111	0.0154	0.0177	0.0172	0.0138	0.0080	0.0023

Table 6.4 Geometric function F_{II} for d_1/W=1.225, d_1/W=1.275, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9097	0.7618	0.6592	0.5860	0.5308	0.4864	0.4490	0.4173
0.125	0.9123	0.7638	0.6608	0.5873	0.5320	0.4874	0.4499	0.4182
0.250	0.9158	0.7664	0.6628	0.5889	0.5332	0.4885	0.4509	0.4190
0.500	0.9257	0.7733	0.6678	0.5926	0.5361	0.4908	0.4528	0.4207
0.750	0.9355	0.7794	0.6723	0.5965	0.5395	0.4937	0.4550	0.4225
1.000	0.9258	0.7697	0.6648	0.5920	0.5381	0.4947	0.4575	0.4249
1.250	0.8618	0.7156	0.6185	0.5520	0.5038	0.4659	0.4342	0.4071
-0.125	0.9079	0.7603	0.6579	0.5848	0.5298	0.4855	0.4481	0.4165
-0.250	0.9071	0.7594	0.6570	0.5839	0.5288	0.4845	0.4472	0.4157
-0.500	0.9082	0.7593	0.6562	0.5826	0.5272	0.4828	0.4455	0.4140
-0.750	0.9120	0.7606	0.6562	0.5820	0.5263	0.4816	0.4440	0.4124
-1.000	0.9068	0.7542	0.6508	0.5783	0.5242	0.4805	0.4431	0.4111
-1.250	0.8618	0.7156	0.6185	0.5520	0.5038	0.4659	0.4342	0.4071

Table 6.5 Geometric function F'_{I} for d_1/W=1.200, d_1/W=1.300, L/W=2.5

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0012	0.0022	0.0029	0.0035	0.0039	0.0043	0.0048	0.0055
0.125	0.0017	0.0030	0.0039	0.0044	0.0047	0.0048	0.0051	0.0056
0.250	0.0023	0.0039	0.0049	0.0054	0.0055	0.0054	0.0054	0.0058
0.500	0.0035	0.0055	0.0066	0.0071	0.0071	0.0069	0.0065	0.0063
0.750	0.0020	0.0023	0.0024	0.0028	0.0039	0.0054	0.0068	0.0074
1.000	-0.0083	-0.0161	-0.0221	-0.0256	-0.0258	-0.0221	-0.0134	-0.0004
1.250	-0.0277	-0.0509	-0.0705	-0.0875	-0.1036	-0.1212	-0.1450	-0.1880
-0.125	0.0007	0.0014	0.0020	0.0026	0.0032	0.0038	0.0045	0.0054
-0.250	0.0002	0.0005	0.0011	0.0017	0.0025	0.0033	0.0042	0.0053
-0.500	-0.0011	-0.0013	-0.0010	-0.0003	0.0007	0.0019	0.0033	0.0049
-0.750	-0.0012	-0.0011	-0.0004	0.0002	0.0007	0.0012	0.0022	0.0041
-1.000	0.0047	0.0098	0.0138	0.0159	0.0155	0.0126	0.0080	0.0043
-1.250	0.0212	0.0393	0.0543	0.0664	0.0759	0.0830	0.0876	0.0867

Table 6.6 Geometric function F_{II} for d_1/W=1.200, d_1/W=1.300, L/W=2.5.

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
0.125	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
0.250	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
0.500	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
1.000	0.9081	0.7606	0.6585	0.5856	0.5307	0.4864	0.4490	0.4173
1.250	0.9084	0.7608	0.6586	0.5857	0.5307	0.4864	0.4490	0.4173
1.500	0.9097	0.7617	0.6591	0.5860	0.5308	0.4865	0.4491	0.4173
2.000	0.9161	0.7654	0.6614	0.5875	0.5318	0.4870	0.4493	0.4174

Table 6.7 Geometric function F'_I for d_1/W=2.50, d_1/W=2.50, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.125	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
1.250	0.0002	0.0003	0.0004	0.0004	0.0003	0.0002	0.0001	0.0000
1.500	0.0006	0.0009	0.0011	0.0010	0.0008	0.0006	0.0003	0.0001
2.000	0.0009	0.0010	0.0009	0.0008	0.0010	0.0012	0.0012	0.0008

Table 6.8 Geometric function F_{II} for d_1/W=2.500, d_1/W=2.500, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
0.125	0.9085	0.7609	0.6588	0.5859	0.5309	0.4867	0.4493	0.4175
0.250	0.9089	0.7613	0.6591	0.5862	0.5312	0.4869	0.4495	0.4178
0.500	0.9098	0.7620	0.6597	0.5868	0.5317	0.4874	0.4499	0.4182
0.750	0.9107	0.7628	0.6604	0.5874	0.5323	0.4879	0.4504	0.4186
1.000	0.9117	0.7636	0.6611	0.5880	0.5328	0.4884	0.4508	0.4190
1.250	0.9131	0.7647	0.6620	0.5887	0.5334	0.4889	0.4513	0.4194
1.500	0.9155	0.7665	0.6632	0.5896	0.5341	0.4894	0.4517	0.4198
-0.125	0.9076	0.7601	0.6581	0.5853	0.5304	0.4862	0.4488	0.4171
-0.250	0.9071	0.7598	0.6578	0.5850	0.5301	0.4859	0.4486	0.4169
-0.500	0.9062	0.7590	0.6571	0.5844	0.5296	0.4854	0.4481	0.4165
-0.750	0.9053	0.7582	0.6565	0.5838	0.5291	0.4850	0.4477	0.4161
-1.000	0.9044	0.7575	0.6558	0.5833	0.5285	0.4845	0.4472	0.4157
-1.250	0.9038	0.7569	0.6553	0.5827	0.5280	0.4840	0.4468	0.4153
-1.500	0.9039	0.7569	0.6550	0.5824	0.5276	0.4835	0.4464	0.4148

Table 6.9 Geometric function F'_{I} for d_1/W=2.45, d_1/W=2.55, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
0.125	0.0002	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
0.250	0.0002	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
0.500	0.0002	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
0.750	0.0003	0.0005	0.0007	0.0008	0.0009	0.0010	0.0012	0.0014
1.000	0.0003	0.0006	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014
1.250	0.0005	0.0009	0.0011	0.0012	0.0013	0.0013	0.0013	0.0014
1.500	0.0009	0.0016	0.0019	0.0020	0.0019	0.0017	0.0016	0.0015
-0.125	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
-0.250	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
-0.500	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
-0.750	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
-1.000	0.0002	0.0004	0.0006	0.0007	0.0009	0.0010	0.0012	0.0014
-1.250	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014
-1.500	-0.0002	-0.0003	-0.0003	-0.0001	0.0002	0.0005	0.0009	0.0013

Table 6.10 Geometric function F_{II} for d_1/W=2.45, d_1/W=2.55, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.9080	0.7605	0.6584	0.5856	0.5307	0.4864	0.4490	0.4173
0.125	0.9089	0.7613	0.6591	0.5862	0.5312	0.4869	0.4495	0.4178
0.250	0.9098	0.7620	0.6597	0.5868	0.5317	0.4874	0.4499	0.4182
0.500	0.9116	0.7636	0.6611	0.5879	0.5328	0.4884	0.4508	0.4190
0.750	0.9134	0.7651	0.6624	0.5891	0.5338	0.4893	0.4517	0.4198
1.000	0.9154	0.7667	0.6638	0.5903	0.5349	0.4903	0.4526	0.4207
1.250	0.9178	0.7687	0.6654	0.5916	0.5360	0.4913	0.4535	0.4215
1.500	0.9215	0.7714	0.6674	0.5932	0.5373	0.4923	0.4544	0.4223
-0.125	0.9071	0.7598	0.6578	0.5850	0.5301	0.4859	0.4486	0.4169
-0.250	0.9062	0.7590	0.6571	0.5844	0.5296	0.4854	0.4481	0.4165
-0.500	0.9044	0.7575	0.6558	0.5833	0.5285	0.4845	0.4472	0.4157
-0.750	0.9025	0.7559	0.6545	0.5821	0.5275	0.4835	0.4463	0.4148
-1.000	0.9007	0.7545	0.6532	0.5809	0.5264	0.4825	0.4455	0.4140
-1.250	0.8991	0.7531	0.6520	0.5798	0.5254	0.4816	0.4446	0.4132
-1.500	0.8981	0.7521	0.6510	0.5788	0.5244	0.4806	0.4437	0.4123

Table 6.11 Geometric function F'_{I} for d_1/W=2.40, d_1/W=2.60, L/W=5.0

e/W	a/W=0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.000	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
0.125	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
0.250	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
0.500	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
0.750	0.0005	0.0010	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
1.000	0.0006	0.0011	0.0015	0.0017	0.0020	0.0021	0.0024	0.0028
1.250	0.0008	0.0014	0.0019	0.0021	0.0023	0.0024	0.0025	0.0028
1.500	0.0013	0.0022	0.0027	0.0030	0.0030	0.0029	0.0028	0.0029
-0.125	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0028
-0.250	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0027
-0.500	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0028
-0.750	0.0005	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0028
-1.000	0.0005	0.0009	0.0012	0.0015	0.0018	0.0020	0.0023	0.0027
-1.250	0.0004	0.0007	0.0009	0.0010	0.0016	0.0019	0.0023	0.0027
-1.500	0.0001	0.0003	0.0005	0.0009	0.0012	0.0017	0.0021	0.0027

Table 6.12 Geometric function F_{II} for d_1/W=2.40, d_1/W=2.60, L/W=5.0