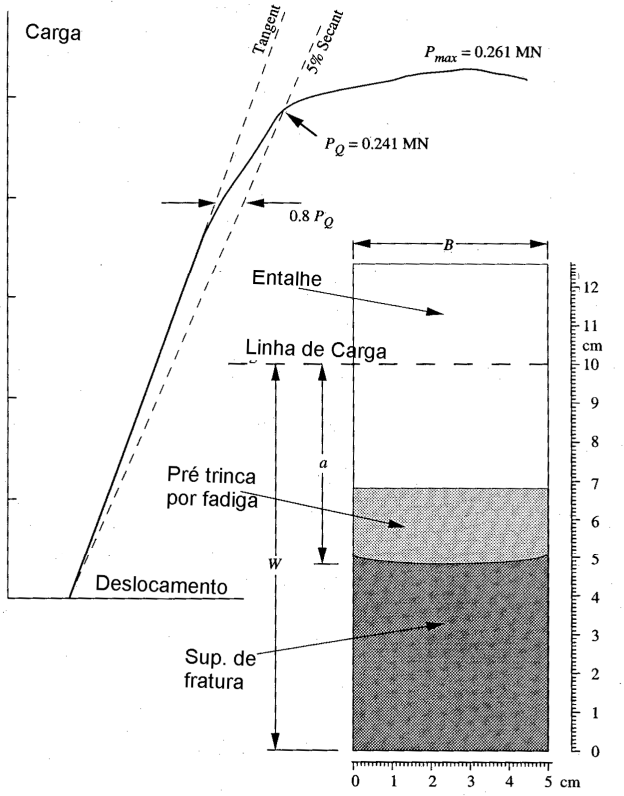
ESCOLA DE ENGENHARIA DE SÃO CARLOS
Departamento de Engenharia de Materiais

Comportamento Mecânico dos Materiais

EXERCÍCIOS

1. A figura abaixo mostra a curva carga versus deslocamento obtidas a partir do ensaio de um corpo de prova do tipo C(T), executado de um material forjado com tensão limite de escoamento de prova de 1500 MPa. Um esquema da fratura deste corpo de prova é mostrado na figura abaixo. Determine se o teste fornece um resultado válido de K_{IC}.

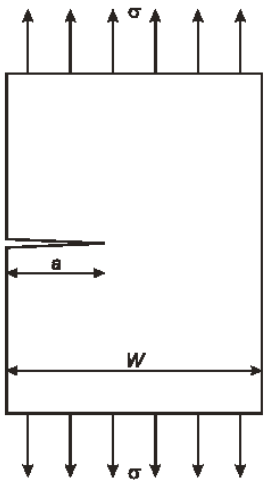


$$a, B, (W - a) \geq 2{,}5\left(\frac{K_Q}{\sigma_y}\right)^2$$

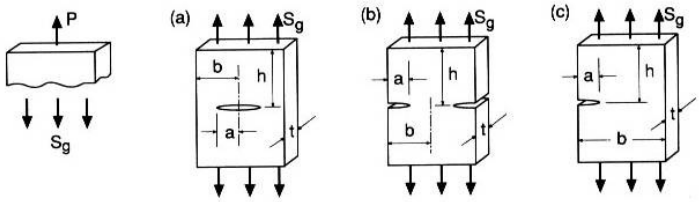
$$K_Q = \frac{P_Q Y}{B W^{1/2}}$$

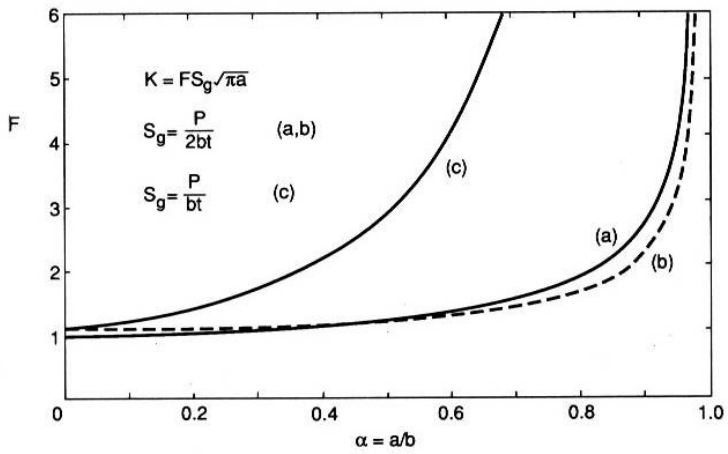
2. (2,0) Considere uma placa com uma trinca de canto (ver figura abaixo). A espessura é tal que a condição de deformação plana.
   Dado: W= 1000 mm

Material	**Tensão de Escoamento, σ_y, [N/mm^2]**	**Tensão Limite de Resist., σ_R [N/mm^2]**	**K_{IC} [N/mm$^{3/2}$]**
Aço 4340	1470	1820	1500
Aço Maraging	1730	1850	2900
Al 7075-T6	500	560	1040



Sabendo que existe uma trinca de 1 mm de comprimento selecione o(s) material(ais) em que poderia(m) ser aplicado(s) uma tensão = 2/3 (σ_y) e que a integridade do componente estaria garantida?





Values for small a/b and limits for 10% accuracy:

(a) $K = S_g\sqrt{\pi a}$ $(a/b \le 0.4)$ (b) $K = 1.12S_g\sqrt{\pi a}$ $(a/b \le 0.6)$ (c) $K = 1.12S_g\sqrt{\pi a}$ $(a/b \le 0.13)$

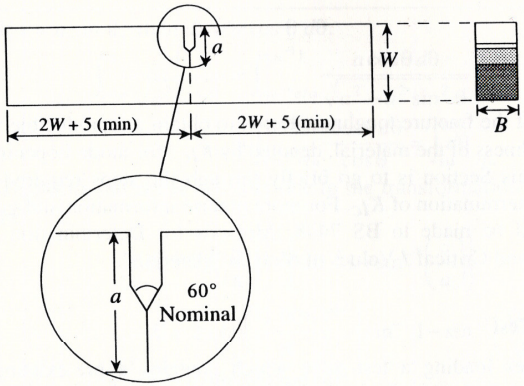
Expressions for any $\alpha = a/b$:

$$\text{(a) } F = \frac{1 - 0.5\alpha + 0.326\alpha^2}{\sqrt{1-\alpha}} \qquad (h/b \ge 1.5)$$

Valores para pequenos a/b e limites para 10% de acuracidade:

$$\text{(c) } F = 0.265\,(1-\alpha)^4 + \frac{0.857 + 0.265\alpha}{(1-\alpha)^{3/2}} \qquad (h/b \ge 1)$$

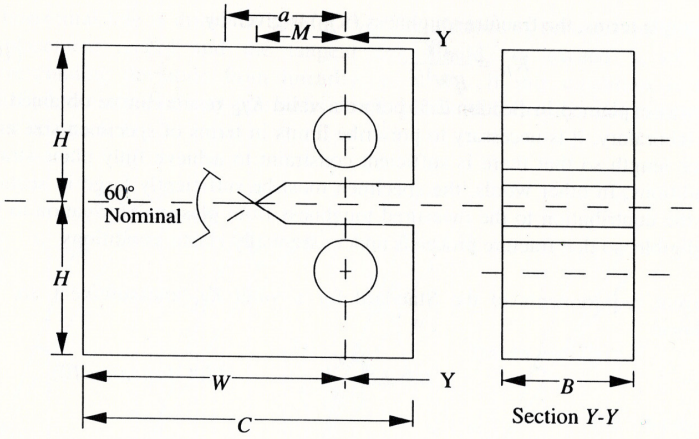
Expressões para qualquer α = a/b:



Width = W
Thickness = $B = 0.5W$
Half Loading Span L = $2W$
Effective crack length a = $0.45W$ to $0.55W$
Dimensions in mm.

Values of Y_1 as a function of a/W for bend testpiece, three point loaded, with half-loading span to testpiece width ratio 2:1.

a/W	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	Stress Intensity factor coefficient, Y_1									
0.450	9.14	9.17	9.20	9.22	9.25	9.28	9.31	9.33	9.36	9.39
0.460	9.42	9.45	9.47	9.50	9.53	9.56	9.59	9.62	9.65	9.68
0.470	9.70	9.73	9.76	9.79	9.82	9.85	9.88	9.91	9.94	9.97
0.480	10.01	10.04	10.07	10.10	10.13	10.16	10.19	10.22	10.26	10.28
0.490	10.32	10.35	10.38	10.42	10.45	10.48	10.52	10.55	10.58	10.62
0.500	10.65	10.68	10.72	10.75	10.78	10.82	10.86	10.89	10.93	10.96
0.510	11.00	11.03	11.07	11.10	11.14	11.18	11.21	11.25	11.29	11.32
0.520	11.36	11.40	11.43	11.47	11.51	11.55	11.59	11.63	11.66	11.70
0.530	11.74	11.78	11.82	11.86	11.90	11.94	11.98	12.02	12.06	12.10
0.540	12.15	12.19	12.23	12.27	12.31	12.35	12.40	12.44	12.48	12.53
0.550	12.57	------	------	------	------	------	------	------	------	------



Net Width = W
Total width C = $1.25W$
Thickness B = $0.5W$
Half height H = $0.6W$
Hole diameter = $0.25W$
Effective notch length M = $0.25W$ to $0.40W$
Effective crack length a = $0.45W$ to $0.55W$
Dimensions in mm.

Values of Y_2 as a function of a/W for a compact tension testpiece

a/W	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	Stress Intensity factor coefficient, Y_2									
0.450	8.34	8.36	8.39	8.41	8.43	8.46	8.48	8.51	8.53	8.56
0.460	8.58	8.60	8.63	8.65	8.68	8.70	8.73	8.75	8.78	8.80
0.470	8.83	8.86	8.88	8.91	8.93	8.96	8.99	9.01	9.04	9.07
0.480	9.09	9.12	9.15	9.17	9.20	9.23	9.26	9.29	9.31	9.34
0.490	9.37	9.40	9.43	9.45	9.48	9.51	9.54	9.57	9.60	9.63
0.500	9.66	9.69	9.72	9.75	9.78	9.81	9.84	9.87	9.90	9.93
0.510	9.96	10.00	10.03	10.06	10.09	10.12	10.16	10.19	10.22	10.25
0.520	10.29	10.32	10.35	10.39	10.42	10.45	10.49	10.52	10.56	10.59
0.530	10.63	10.66	10.70	10.73	10.77	10.80	10.84	10.87	10.91	10.95
0.540	10.98	11.02	11.06	11.10	11.13	11.17	11.21	11.24	11.29	11.33
0.550	11.36	------	------	------	------	------	------	------	------	------