Problem: Pressurized straight crack in an infinite medium
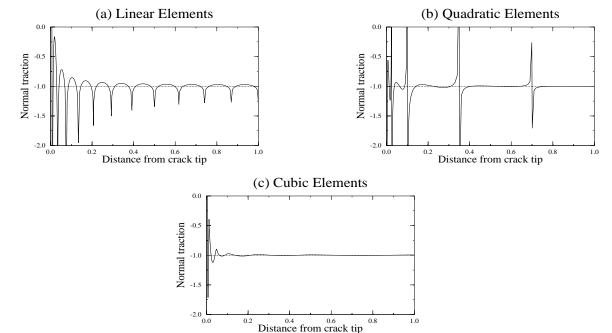
Numerical Model: The crack was modelled by displacement discontinuity. The density function was modelled using Linear Lagrange elements, Quadratic Lagrange elements, and Cubic Hermite polynomials. The total number of unknowns in each case was 52.

Results: Stress intensity factors were calculated by the J-integral, least square, and crack opening displacement methods and compared with the analytical non-dimensional stress intensity factor value of 1.

Table 1: Non-dimensional Stress Intensity Factors for Straight Crack

Approximation	J-integral	Least Squares	CPU time[a]
Linear	0.999	1.002	0.30 sec
Quadratic	1.001	1.006	0.36 sec
Cubic	0.999	1.001	0.43 sec

a. Sun Sparcstation IPX computer

The normal stress in the load direction in front of the crack is plotted and shown below. The result shows that cubic Hermite approximation yields the smoothest behavior.

(a) Linear Elements

(b) Quadratic Elements

(c) Cubic Elements