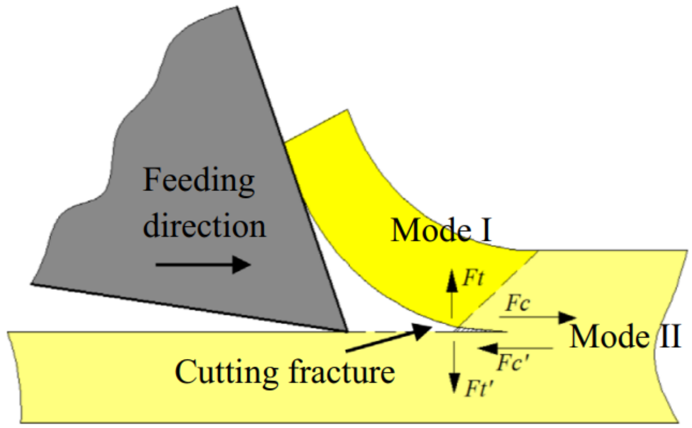
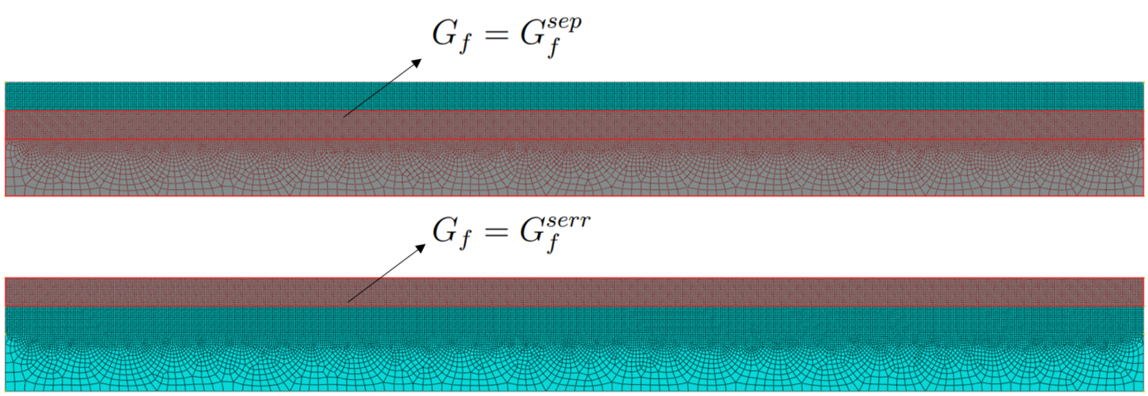


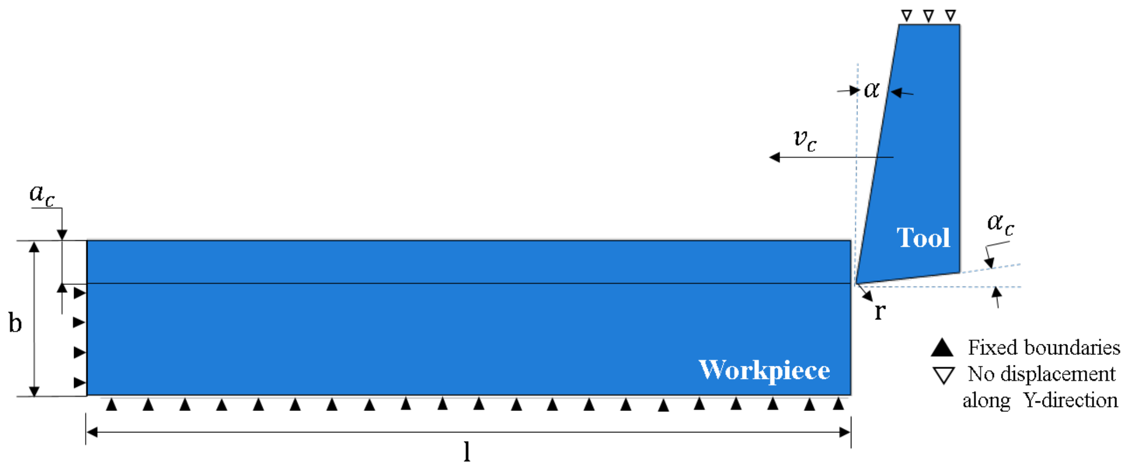
Fracture modes in orthogonal cutting model.



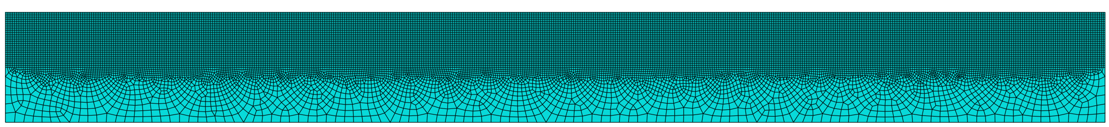
Energy spent to form new surface when chip generates, $G_{\mathrm{f}}^{\mathrm{sep}}$, Energy spent in forming new surface for chip serration, $G_{\mathrm{f}}^{\mathrm{serr}}$.

For isotropic linear elastic material fracture toughness, G_{f} can be defined as:

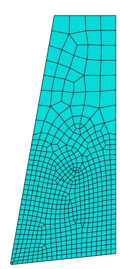
$$G_{\mathrm{f}}^{(\mathrm{sep,serr})} = \frac{1-\nu^2}{E}\mathrm{K}_{\mathrm{Ic,IIc}}^2, \quad \text{for plane strain} \tag{1}$$



Tool- Workpiece.



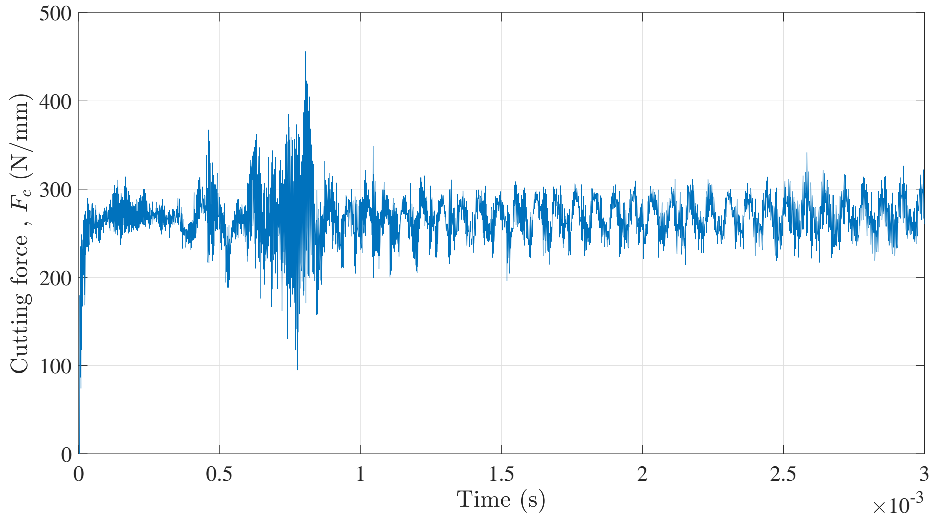
(a)



(b)

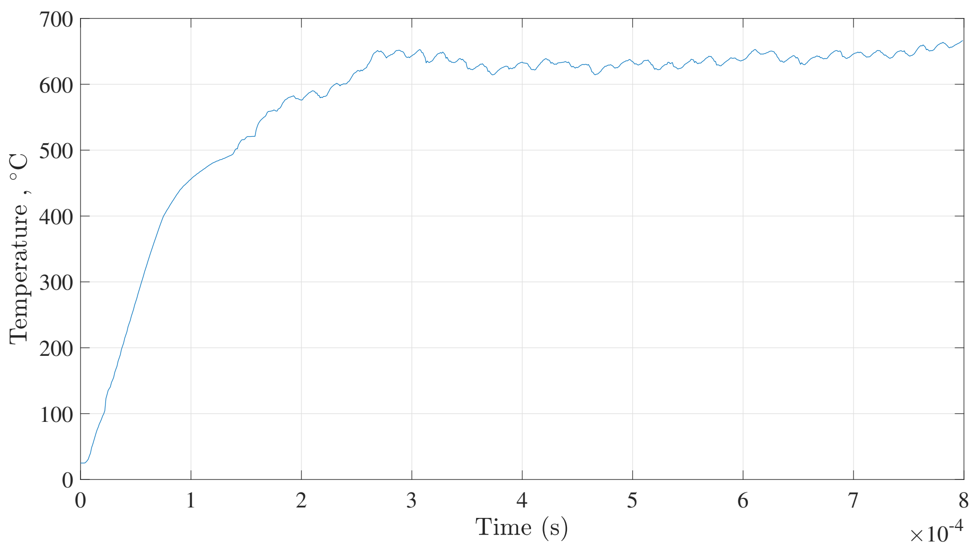
Meshed geometry (a) workpiece (b) tool.

Force Distribution



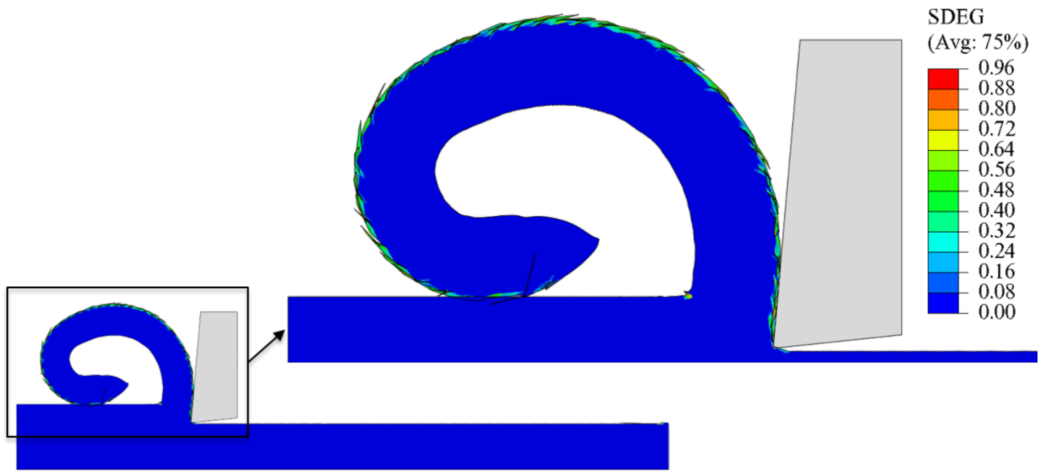
Cutting force evolution versus time for $\alpha = 0°$, a_c= 0.1 mm, and V_c= 200 m/min.

Temperature Distribution

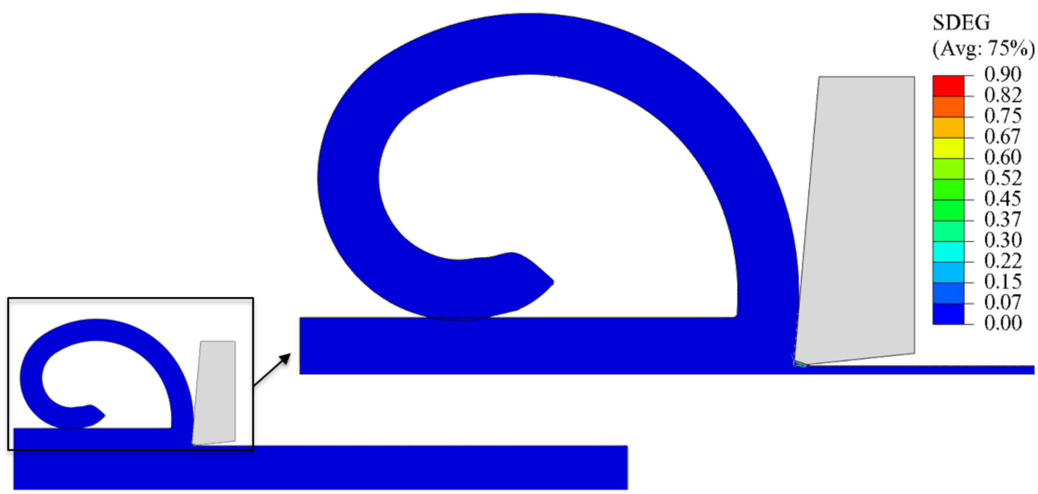


Tool chip interface temperature evolution versus time for $\alpha = -7°$, a_c= 0.3 mm, and V_c= 800 m/min.

Comparison of SDEG for Two Sets of Johnson-Cook Parameters



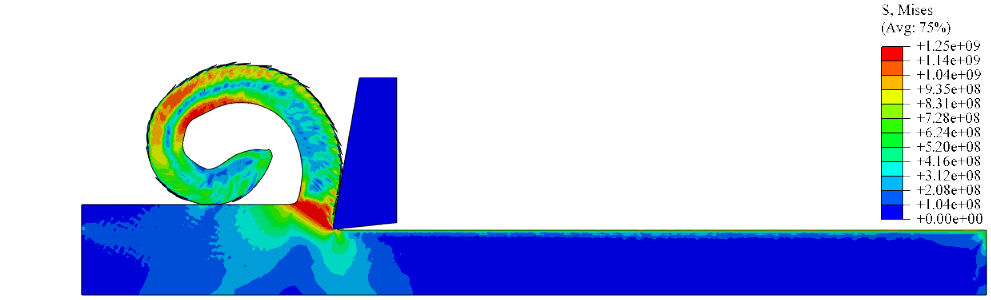
(a)



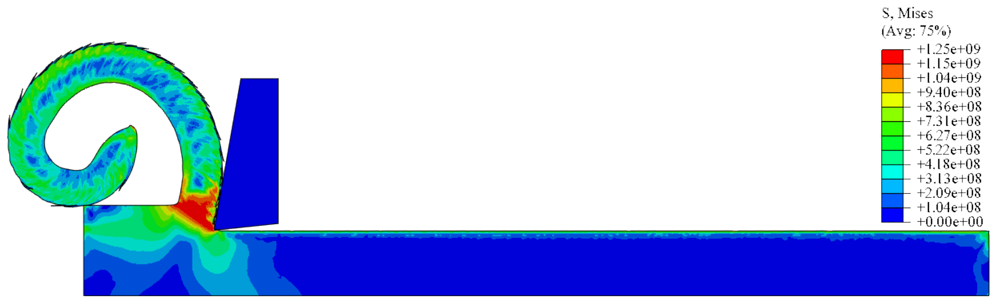
(b)

SDEG results (a) Johnson-Cook parameters- I (b) Johnson-Cook parameters - II for $\alpha = 5$, $a_c = 0.3$ mm, and $V_c = 800$ m/min.

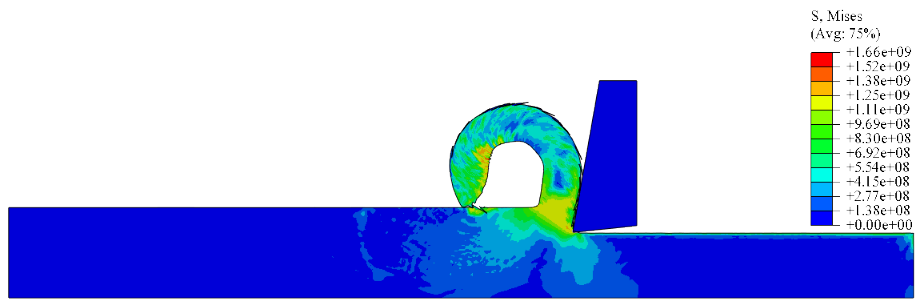
Change in Fracture Toughness for Chip Serration



(a)



(b)



(c)

Different chip morphology for different (a) $G_{\mathrm{f}}^{\mathrm{serr}} = 20000$ J/m^2 (b) $G_{\mathrm{f}}^{\mathrm{serr}} = 24000$ J/m^2 (c) $G_{\mathrm{f}}^{\mathrm{serr}} = 28000$ J/m^2, for $G_{\mathrm{f}}^{\mathrm{sep}}$= 14000J/m^2, $\alpha = 10°$, $a_{\mathrm{c}} = 0.3$ mm, and $V_{\mathrm{c}} = 800$ m/min.