

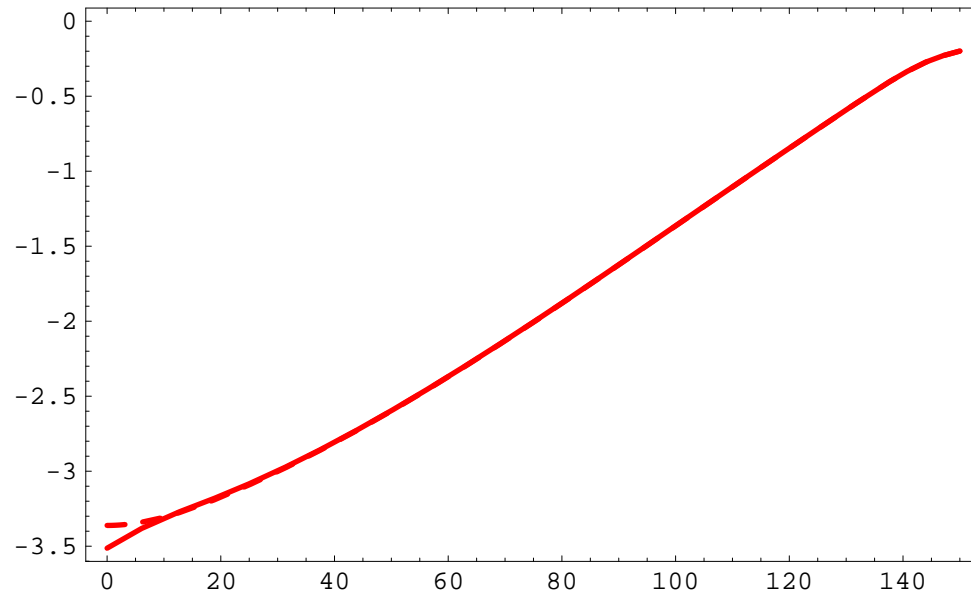
Three point bending

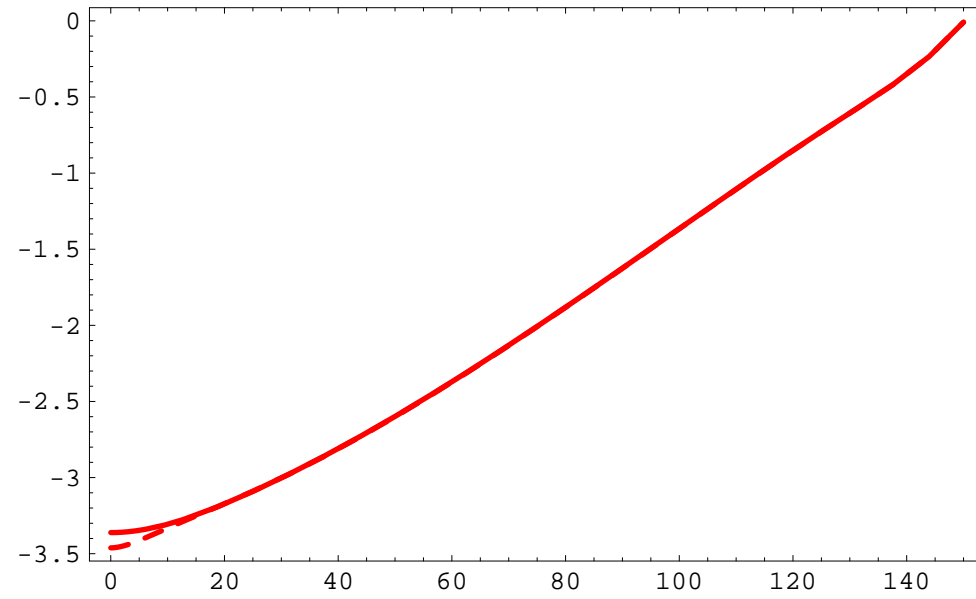
(mixed identification)

Solution descriptions

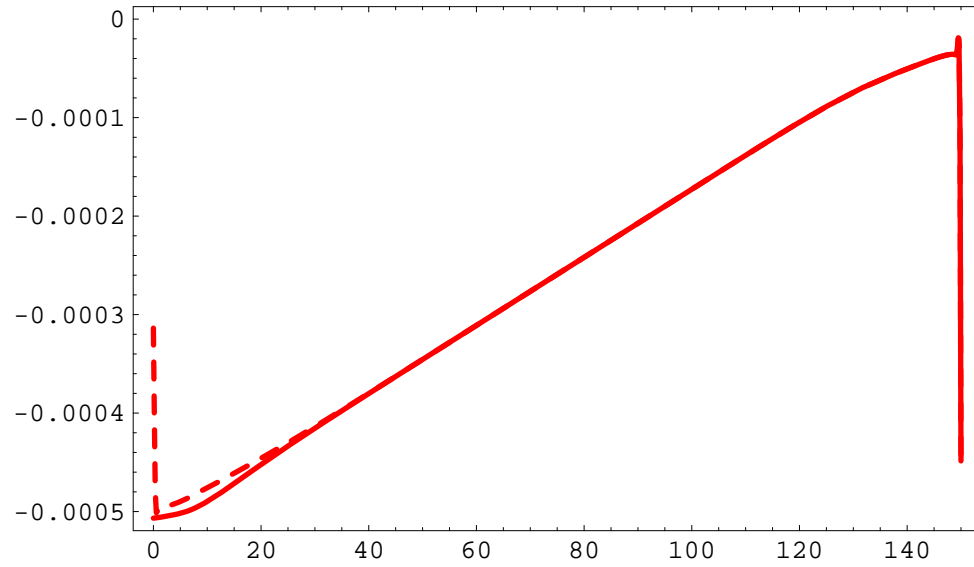
■ Displacement and stress

■ Transverse displacement (lamina 3)

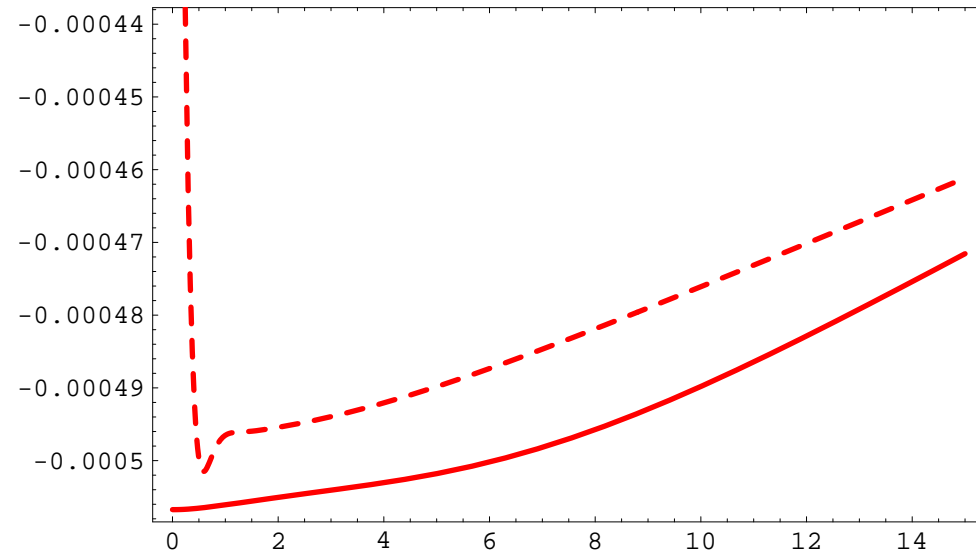


■ Transverse displacement (lamina 1)

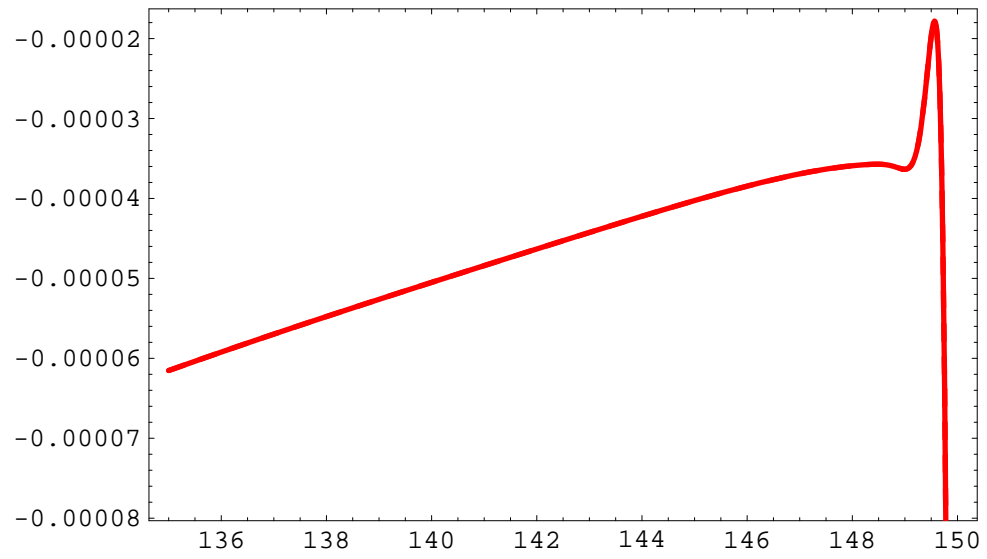
■ Transverse elongation (lamina 1)



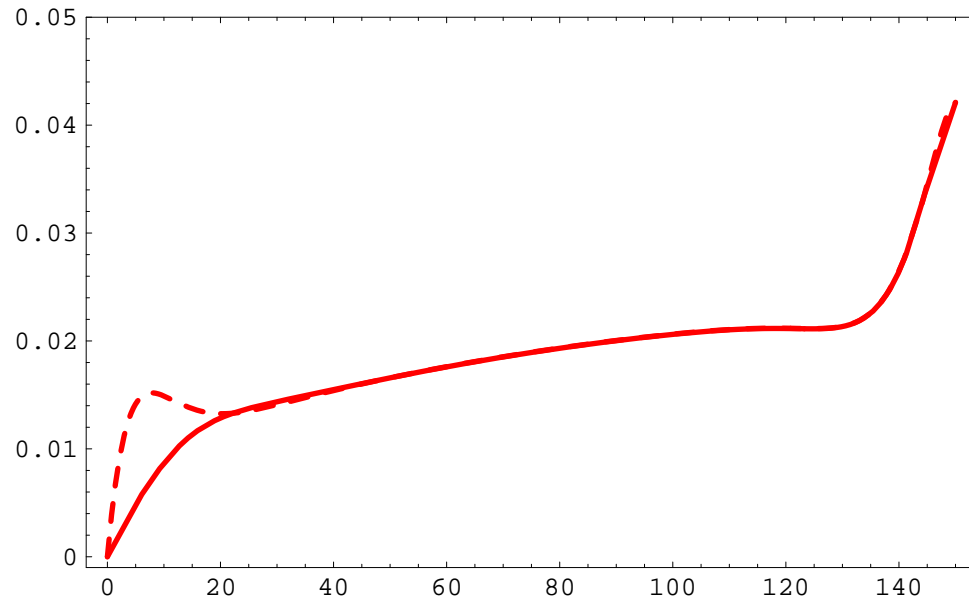
■ Transverse elongation (lamina 1) (left end)



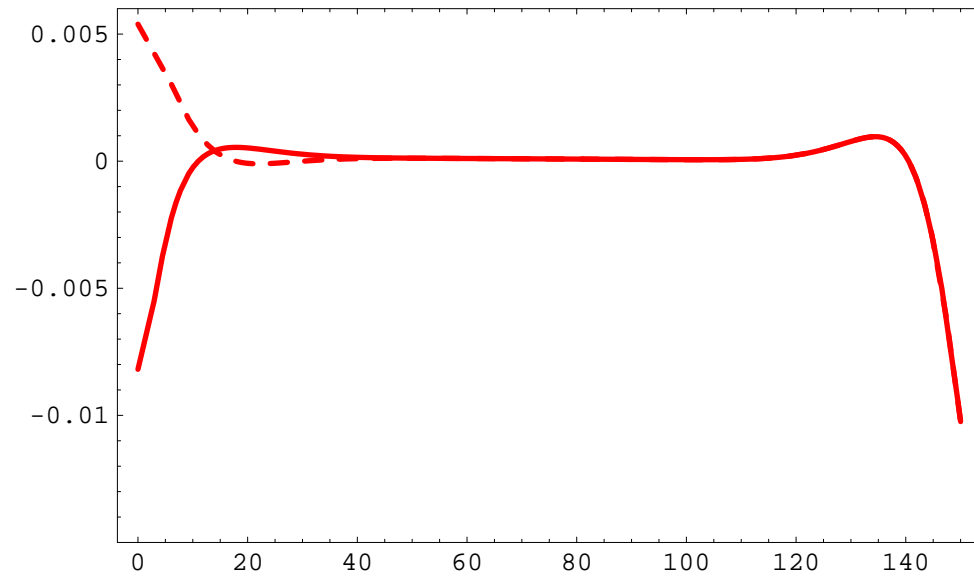
■ Transverse elongation (lamina 1) (right end)



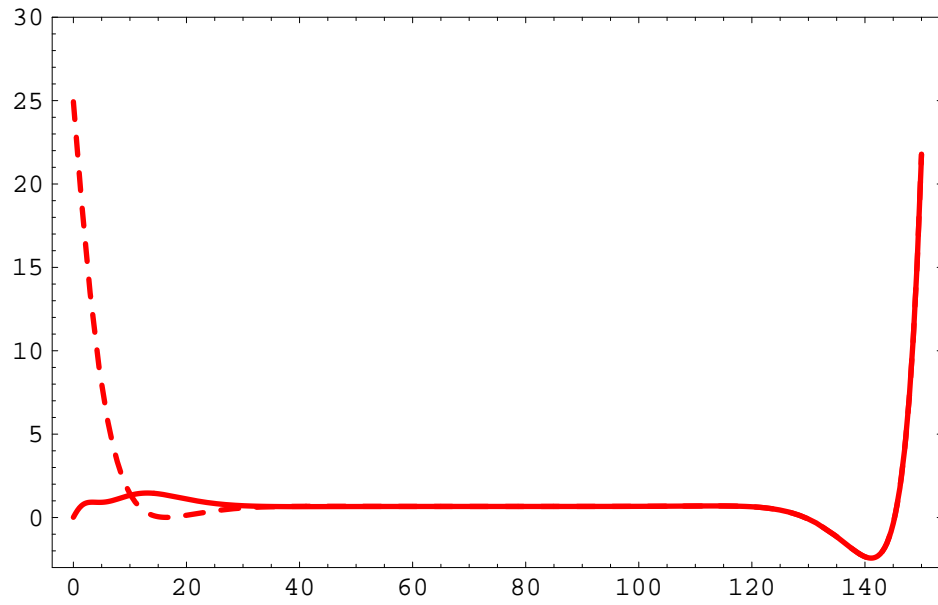
■ Rotation (lamina 1)



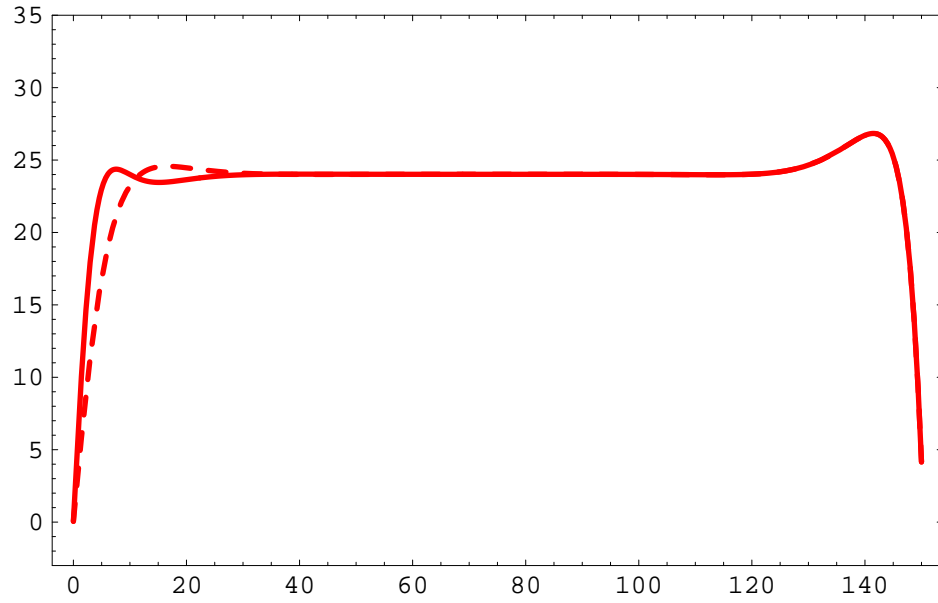
■ Transverse elongation (lamina 2)



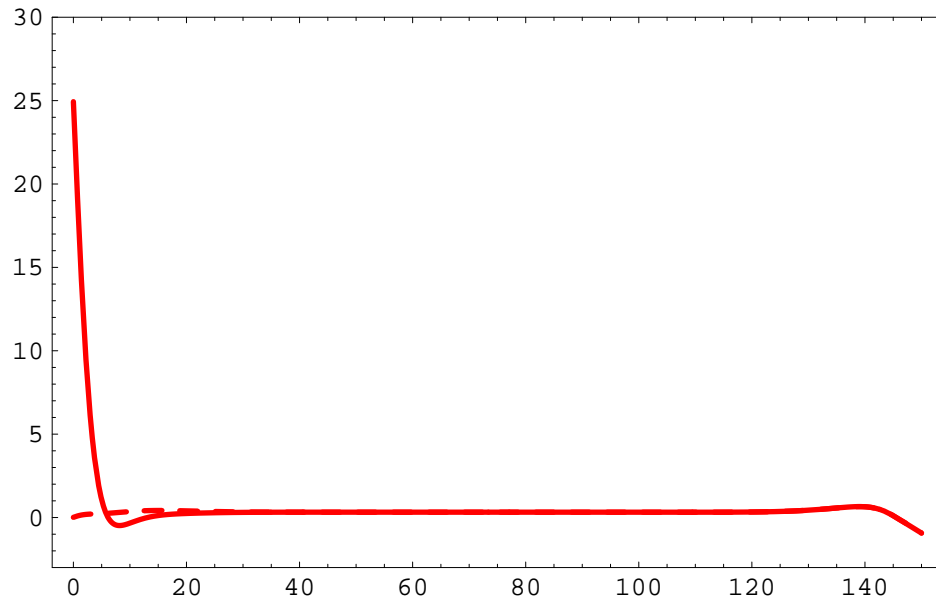
■ Shear force (lamina 1)



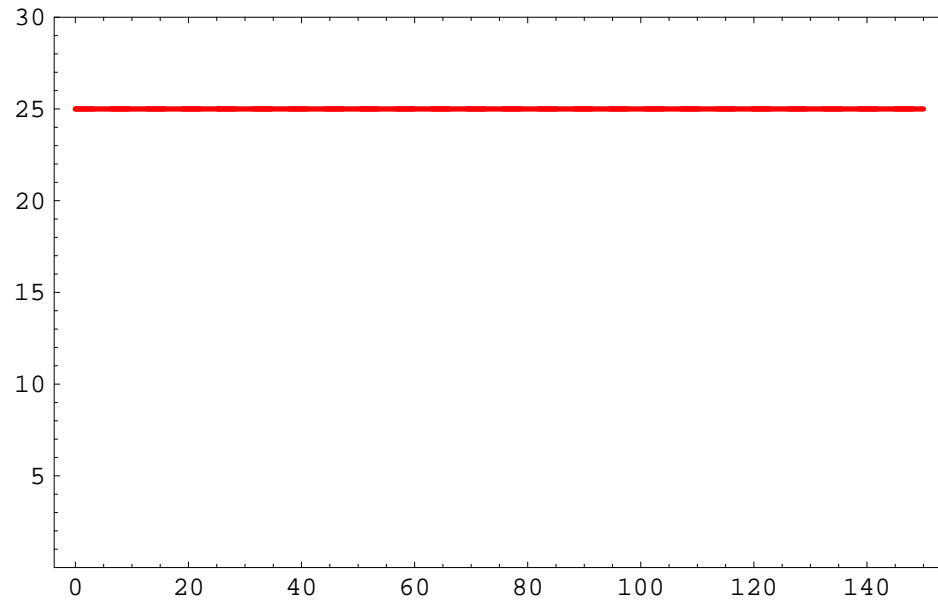
■ Shear force (lamina 2)



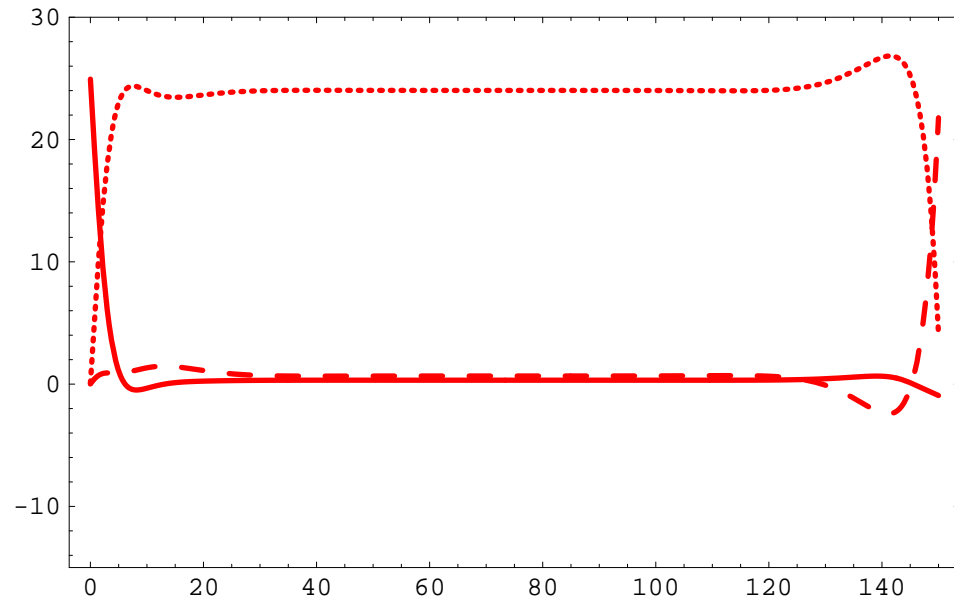
■ Shear force (lamina 3)



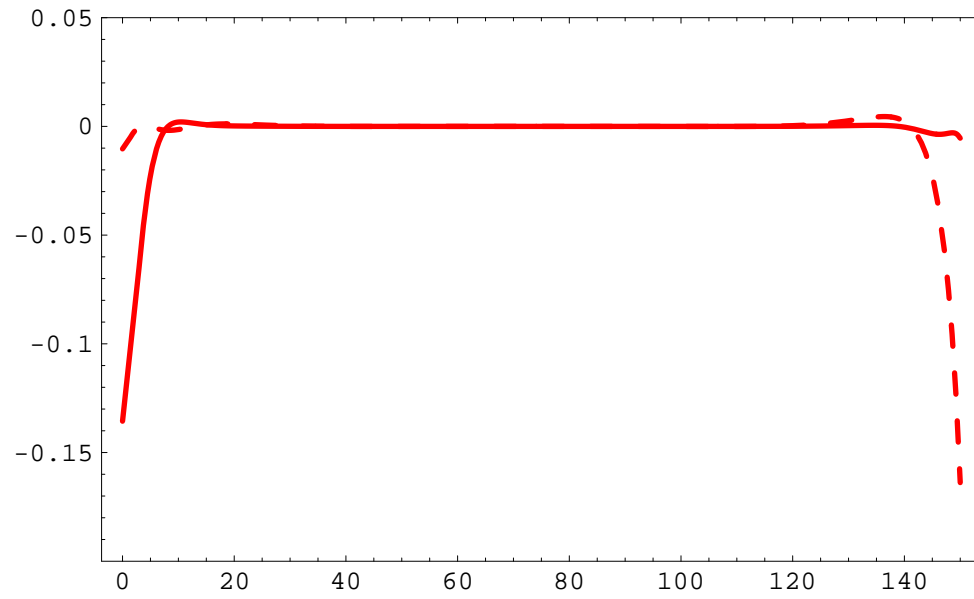
■ Shear force (total)



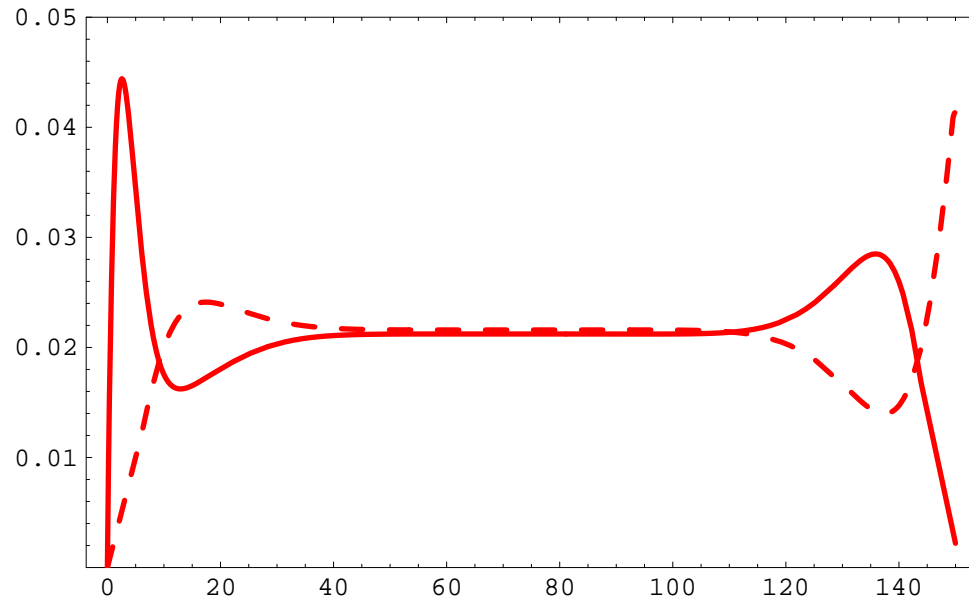
■ Shear force (laminae 1,2,3) (case "f-top")



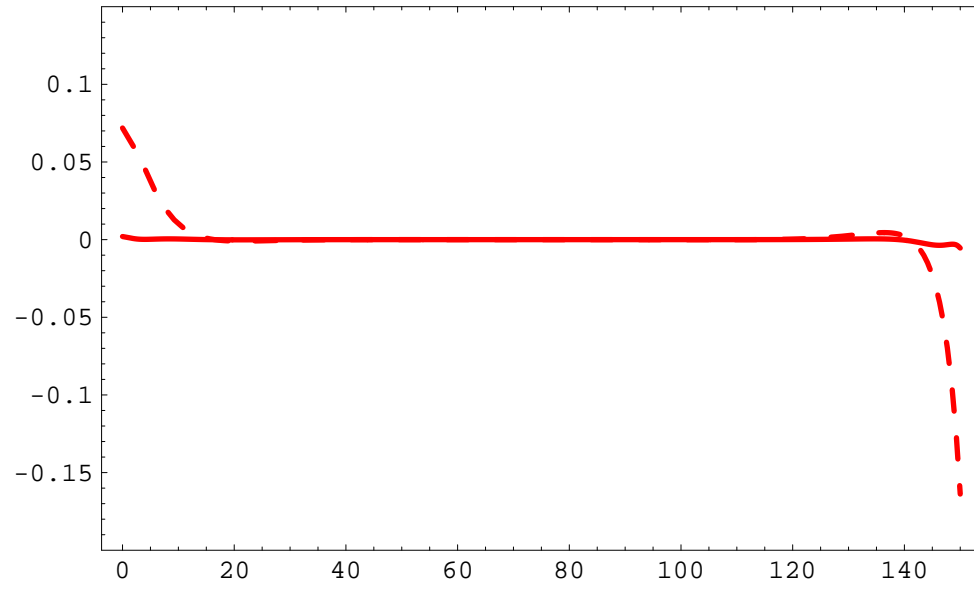
■ Normal interlaminar stress (case "f-top")



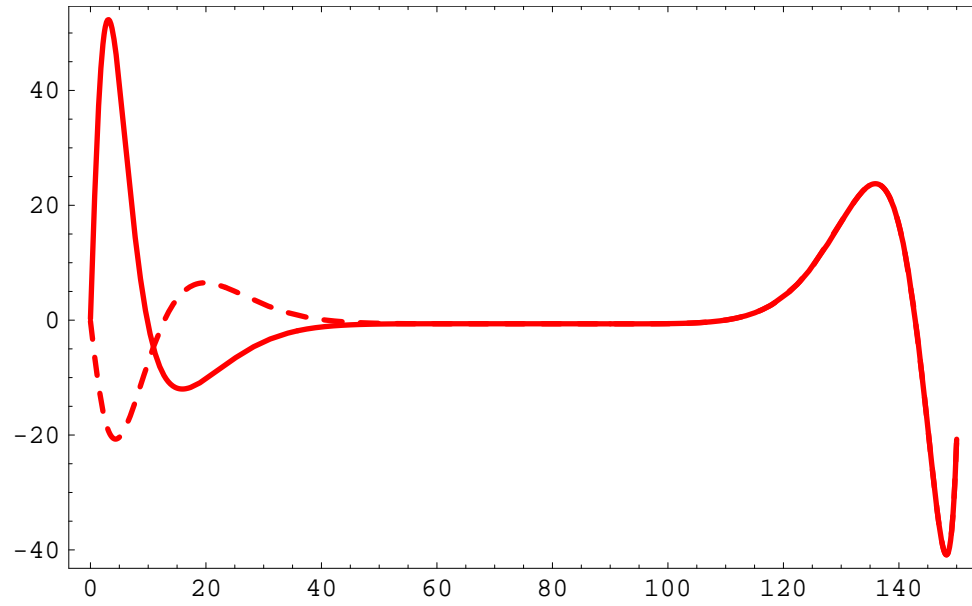
■ Tangential interlaminar stress (case "f-top")



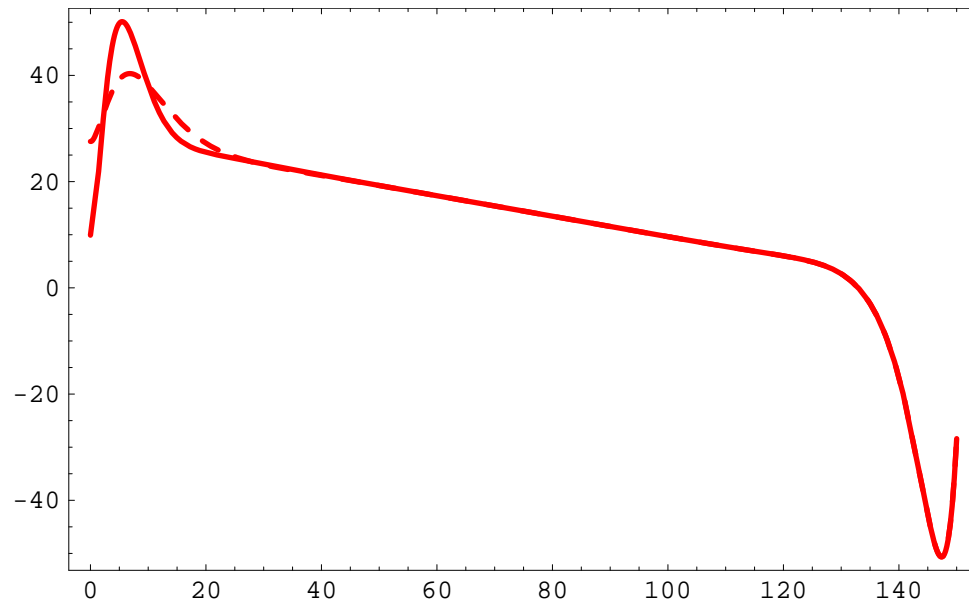
■ Normal interlaminar stress (case "f-bot")



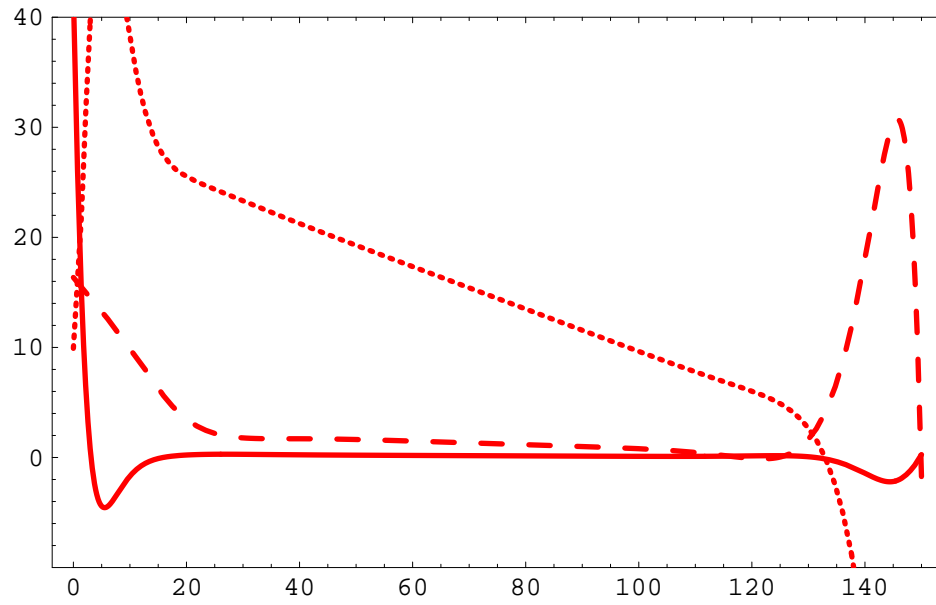
■ Shear force



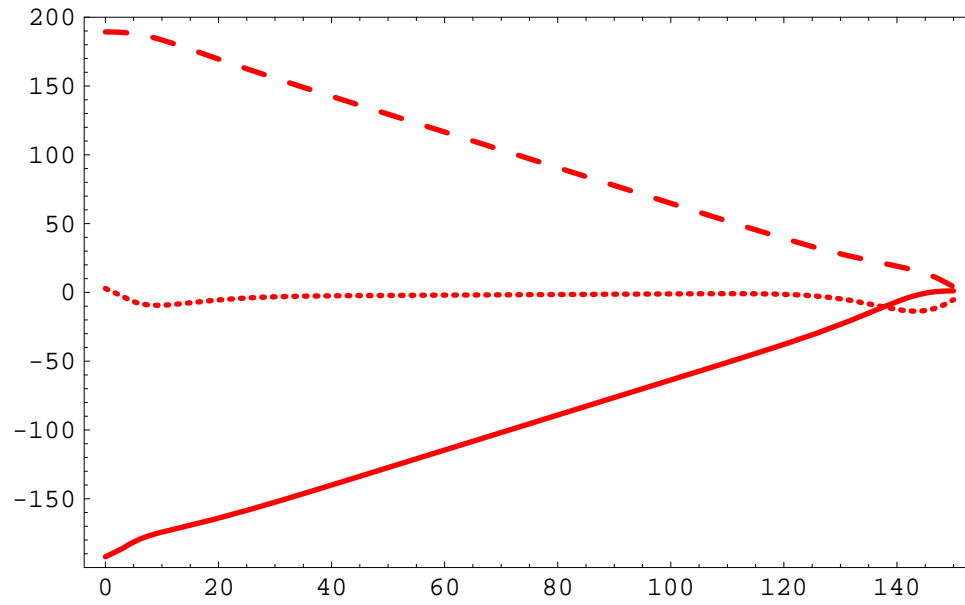
■ Bending moment (lamina 2)



■ Bending moment (laminae 1,2,3) (case "f-top")

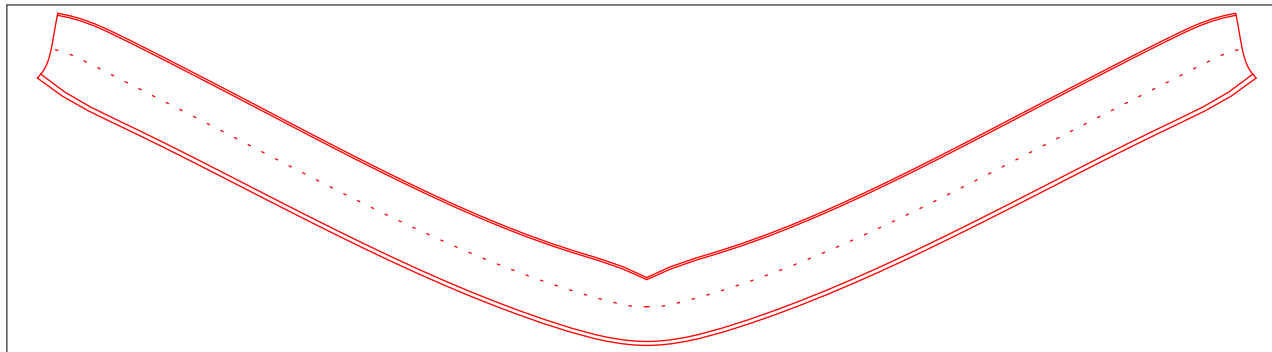


■ Normal force (laminae 1,2,3) (case "f-top")

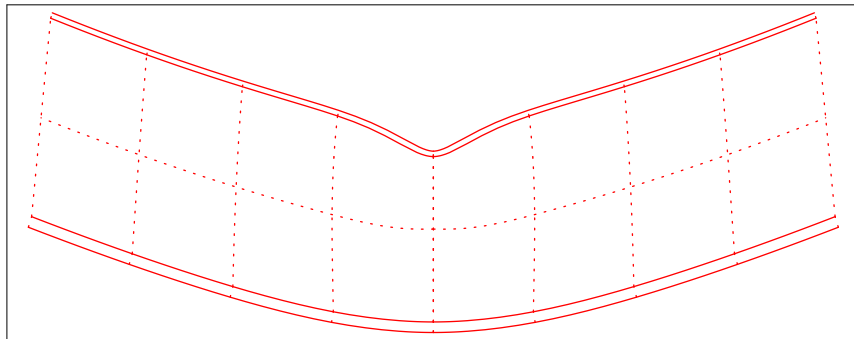


■ Shape

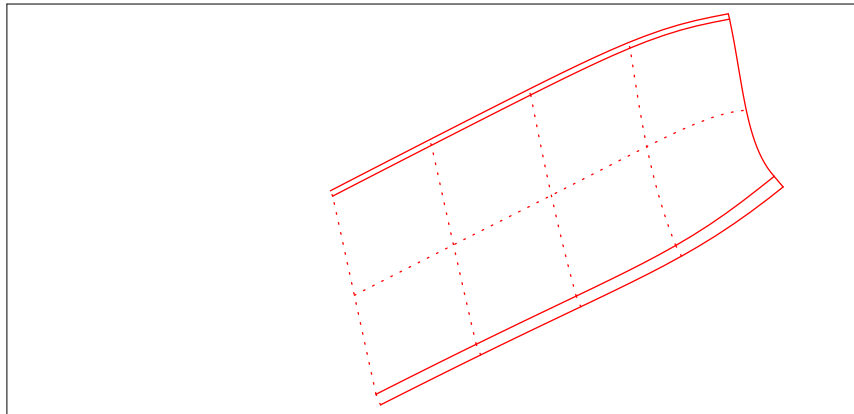
■ Overall shape



■ Blow up at midspan



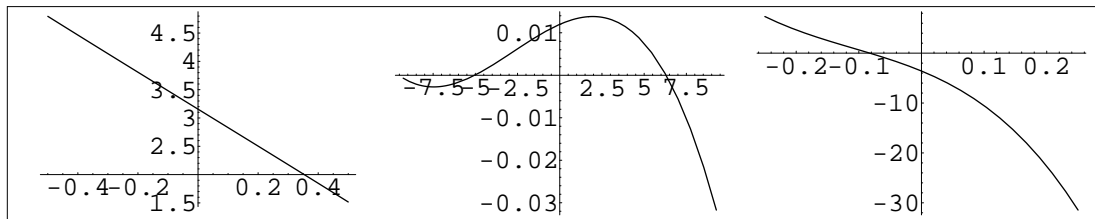
■ Blow up at the right end



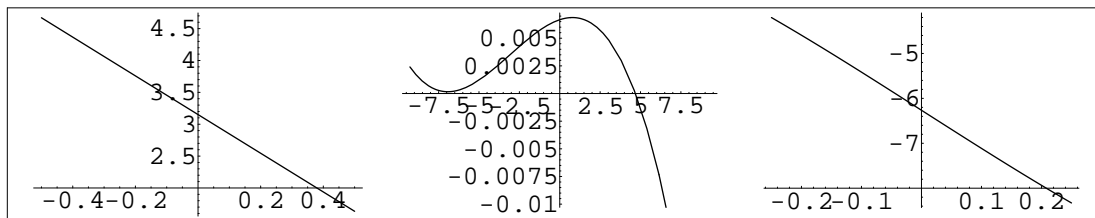
■ Stress in selected cross sections

■ Normal stress on cross sections

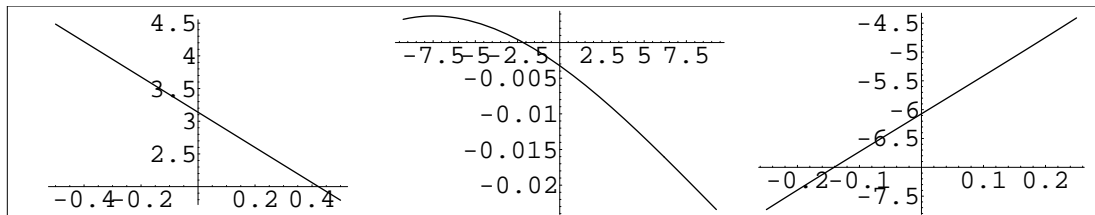
```
plot[sL, scfc["f-top"]];
```



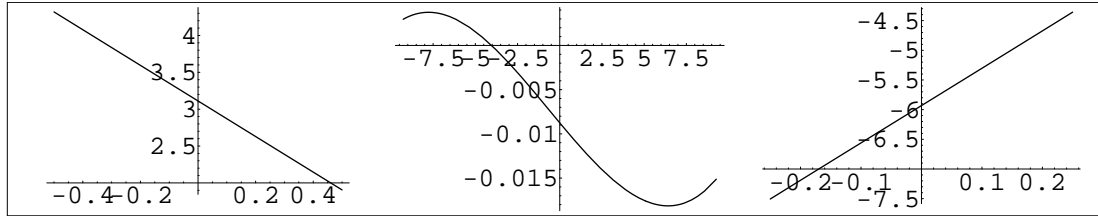
```
plot[sL +  $\frac{hl[2]}{4}$ , scfc["f-top"]];
```



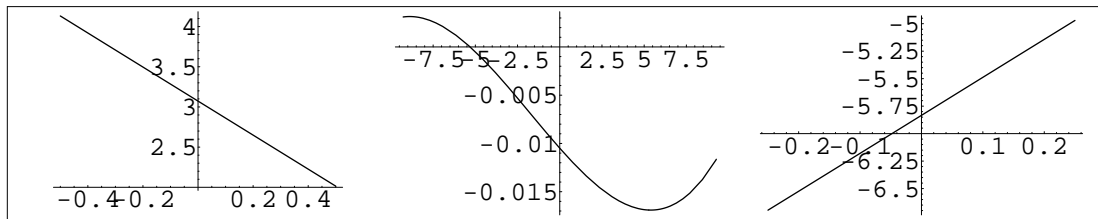
```
plot[sL + 2  $\frac{hl[2]}{4}$ , scfc["f-top"]];
```



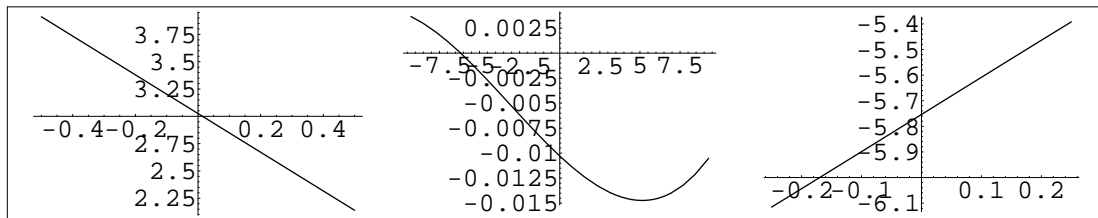

```
plot[sL + 3  $\frac{hl[2]}{4}$ , scfc["f-top"]];
```



```
plot[sL + 4  $\frac{hl[2]}{4}$ , scfc["f-top"]];
```

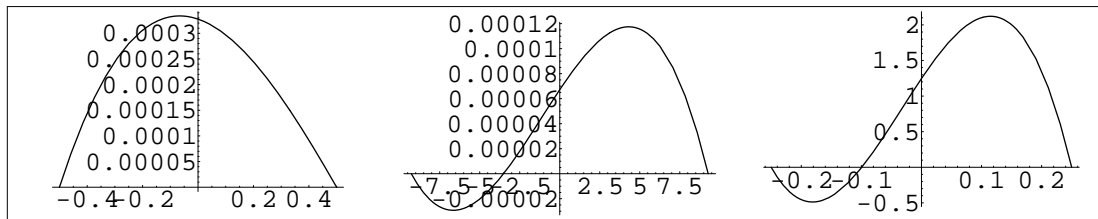


```
plot[sL + 5  $\frac{hl[2]}{4}$ , scfc["f-top"]];
```

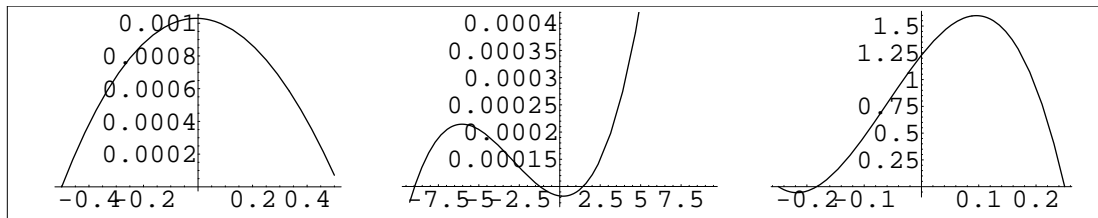


■ Shear stress on cross sections

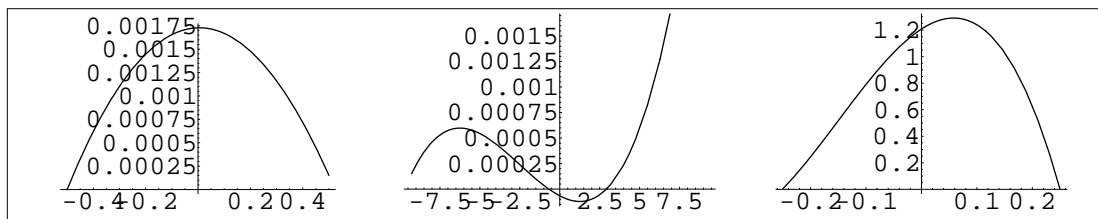
```
plt[sL, scfc["f-top"]];
```



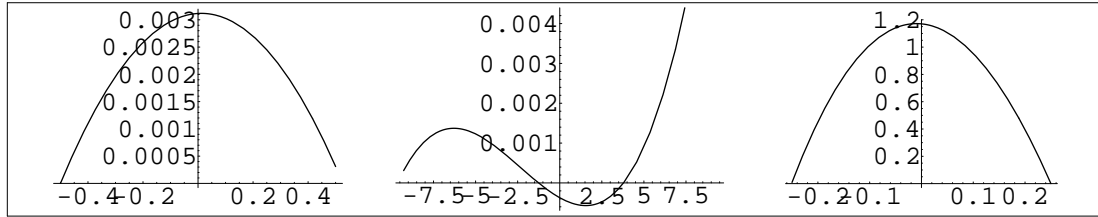
```
plt[sL +  $\frac{h1[2]}{200}$ , scfc["f-top"]];
```



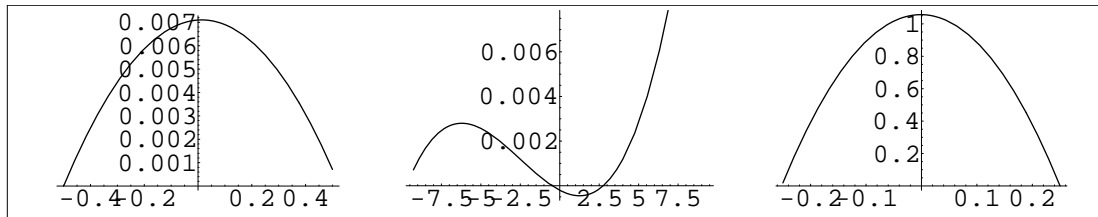
```
plt[sL + 2 *  $\frac{h1[2]}{200}$ , scfc["f-top"]];
```



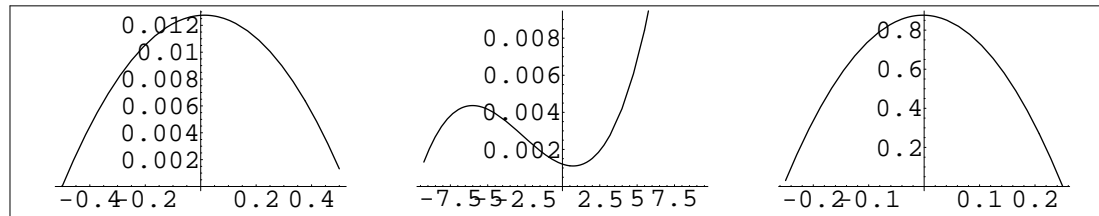
```
plt[sL + 4  $\frac{hl[2]}{200}$ , scfc["f-top"]];
```



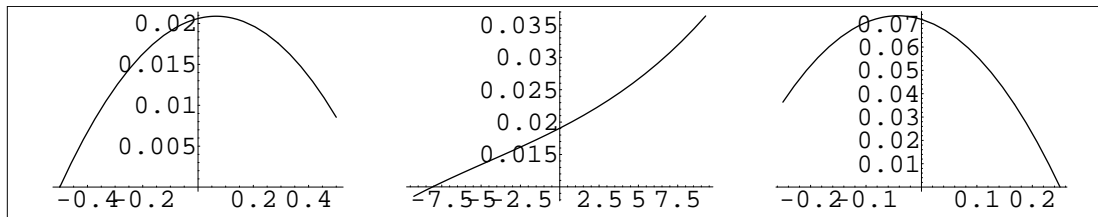
```
plt[sL + 10  $\frac{hl[2]}{200}$ , scfc["f-top"]];
```



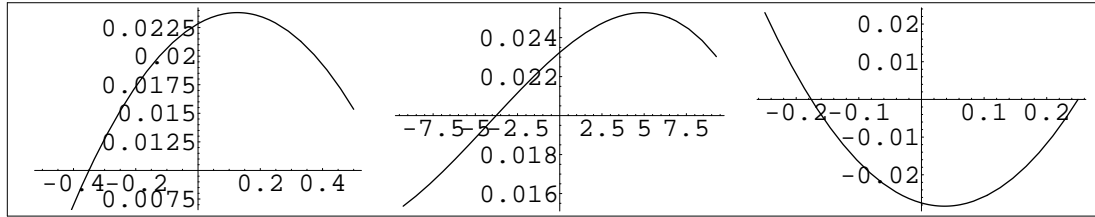
```
plt[sL + 20  $\frac{hl[2]}{200}$ , scfc["f-top"]];
```



```
plt[sL + 100  $\frac{hl[2]}{200}$ , scfc["f-top"]];
```

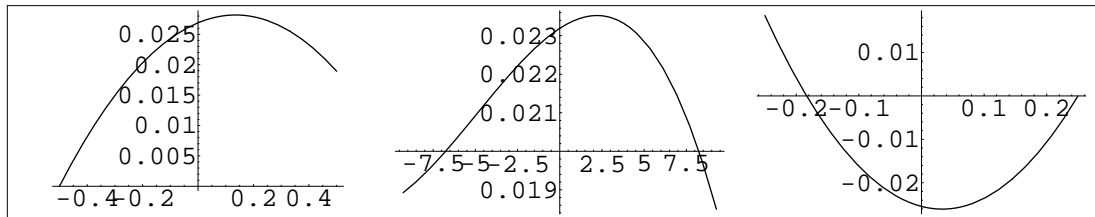


```
plτ[sL + 160  $\frac{hl[2]}{200}$ , scfc["f-top"]];
```



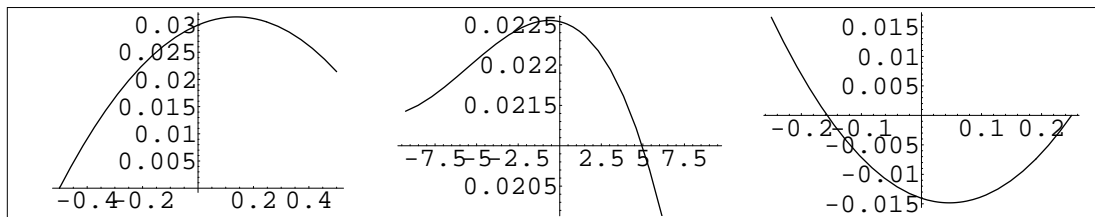
```
Block[{sh = 200  $\frac{hl[2]}{200}$ }, Print["s=", N[ $\frac{sh}{L}$ ], " L"]; plτ[sL + sh, scfc["f-top"]];
```

s=0.0618333 L



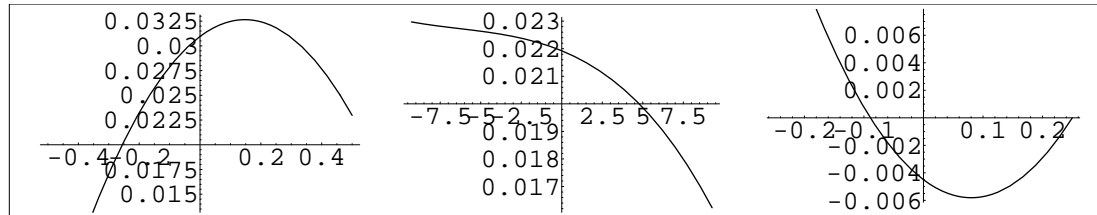
```
Block[{sh = 240  $\frac{hl[2]}{200}$ }, Print["s=", N[ $\frac{sh}{L}$ ], " L"]; plτ[sL + sh, scfc["f-top"]];
```

s=0.0742 L

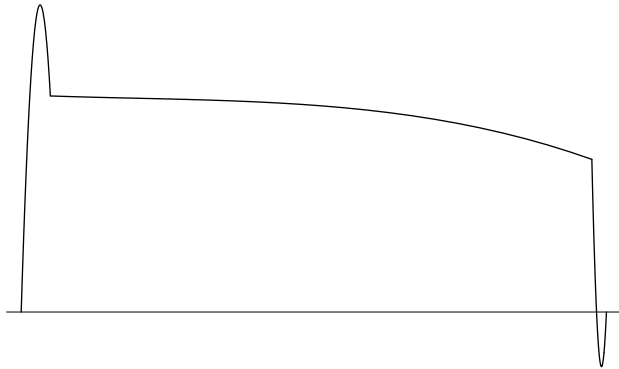


```
Block[{sh = 280  $\frac{h1[2]}{200}$ }, Print["s=", N[ $\frac{sh}{L}$ ], " L"]; Plot[sL + sh, scfc["f-top"]];
```

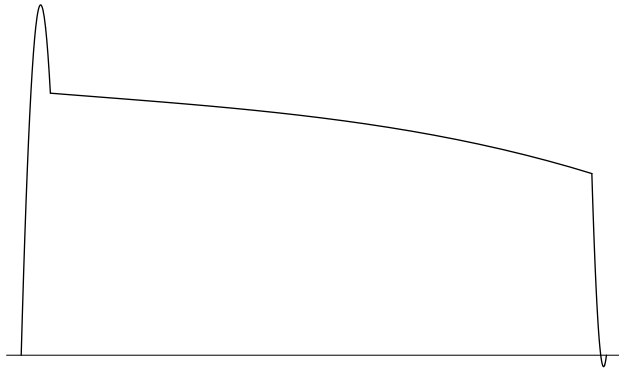
```
s=0.0865667 L
```



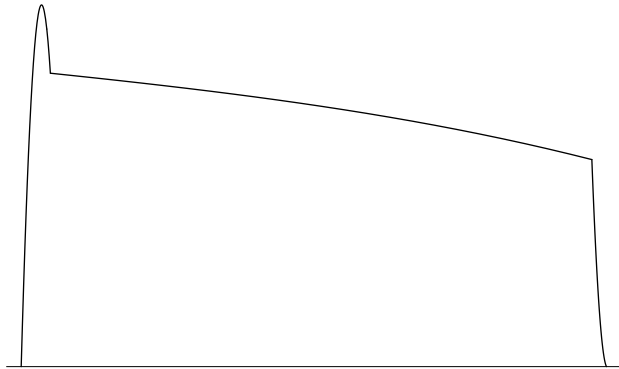
s=0.0865667 L



s=0.0989333 L



s=0.1113 L



s=0.247333 L



■ Values of the stress at the boundary

```
Block[{evf = Together[(Collect[N1[sL] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{189.34, 190.637}
```

```
Block[{evf = Together[(Collect[N2[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-5.33443, -5.33443}
```

```
Block[{evf = Together[(Collect[Q1[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{21.7803, 21.7803}
```

```
Block[{evf = Together[(Collect[Q2[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{4.15117, 4.15117}
```

```
Block[{evf = Together[(Collect[Q3[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-0.931475, -0.931474}
```

```
Block[{evf = Together[(Collect[M1[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-1.76705, -1.76705}
```

```
Block[{evf = Together[(Collect[M2[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-28.3924, -28.3924}
```

```
Block[{evf = Together[(Collect[T1[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-7.03851, -7.03851}
```

```
Block[{evf = Together[(Collect[T2[sR] × width /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-20.7293, -20.7293}
```

```
Block[{evf = Together[(Collect[σ1[sR] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-0.163815, -0.163815}
```

```
Block[{evf = Together[(Collect[σ2[sR] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-0.00541035, -0.00541034}
```

```
Block[{evf = Together[(Collect[τ1[sR] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{0.0420577, 0.0420577}
```

```
Block[{evf = Together[(Collect[τ2[sR] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{0.00220539, 0.00220539}
```

```
Block[{evf = Together[(Collect[ $\sigma_1$ [sL] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-0.0103459, 0.0718667}
```

```
Block[{evf = Together[(Collect[ $\sigma_2$ [sL] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{-0.135583, 0.00199896}
```

```
Block[{evf = Together[(Collect[ $\tau_1$ [sL] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{0, 0}
```

```
Block[{evf = Together[(Collect[ $\tau_2$ [sL] /. fsol, cf[all]]) /. scfc[cases]]}, evf] // Chop
```

```
{0, 0}
```