

**GEORGIA INSTITUTE OF TECHNOLOGY**  
**ENG 4793 Composite Materials and Processes**

**Spring 2002**

Compression Molding Example

Parameters:

Viscosity: 0.3 kPa•s (typical of polypropylene)

Carbon fiber modulus: 234 GPa

$V_o$  (initial volume fraction): 0.55

$V_a$  (available volume fraction): 0.85

$k$  (Kozeny coefficient): 0.7 (axial flow)

$r_f$  (carbon fiber radius): 4 microns

$a$  (length of fiber we're trying to fill with resin): 0.01m

beta (fiber arch ratio): 350

$dv_f/dt$  (time rate of change of volume fraction): 0.0001

Equations:

$$p_a = \bar{p}_r + s$$

$$\bar{p}_r = \frac{h}{3} \frac{a^2}{S_{xx} v_f} \frac{dv_f}{dt}$$

$$s = \frac{3pE}{b^4} \frac{\sqrt{\frac{v_f}{v_o}} - 1}{\left( \sqrt{\frac{v_a}{v_f}} - 1 \right)^4}$$

$$S = \frac{r_f^2}{4k} \frac{(1 - v_f)^3}{v_f^2}$$

Sheet1

Volume Fraction	Fiber Pressure (MPa)	Resin Pressure (MPa)	Volume Fraction
0.55	0.00E+00	1.06E+00	0.55
0.56	4.59E-04	1.15E+00	0.56
0.57	1.11E-03	1.25E+00	0.57
0.58	2.01E-03	1.37E+00	0.58
0.59	3.26E-03	1.50E+00	0.59
0.6	4.99E-03	1.64E+00	0.6
0.61	7.37E-03	1.80E+00	0.61
0.62	1.06E-02	1.98E+00	0.62
0.63	1.52E-02	2.18E+00	0.63
0.64	2.14E-02	2.40E+00	0.64
0.65	3.02E-02	2.65E+00	0.65
0.66	4.24E-02	2.94E+00	0.66
0.67	5.98E-02	3.26E+00	0.67
0.68	8.47E-02	3.63E+00	0.68
0.69	1.21E-01	4.05E+00	0.69
0.7	1.74E-01	4.54E+00	0.7
0.71	2.55E-01	5.09E+00	0.71
0.72	3.78E-01	5.74E+00	0.72
0.73	5.72E-01	6.49E+00	0.73
0.74	8.87E-01	7.37E+00	0.74
0.75	1.42E+00	8.40E+00	0.75
0.76	2.35E+00	9.62E+00	0.76
0.77	4.09E+00	1.11E+01	0.77
0.78	7.55E+00	1.28E+01	0.78
0.79	1.51E+01	1.49E+01	0.79
0.8	3.38E+01	1.75E+01	0.8
0.81	8.86E+01	2.07E+01	0.81
0.82	3.01E+02	2.46E+01	0.82
0.83	1.63E+03	2.96E+01	0.83

