Homework #8

Exercise for Section 9.3 (p. 369)

The analog to Table 9.9 for the principal material coordinate system stresses in each layer of the $[\pm 45/0_2]_S$ laminate due to the loading $N_x = n$, $N_y = -0.200$ MN/m, $N_{xy} = 0$ follows. The program *stress.f* was used to compute the stresses.

Table 1: Principal material system stresses (Pa) in $[\pm 45/0_2]_S$ laminate

Layer	σ_1	σ_2	τ_{12}
+45°	$+227n - 409\text{x}10^6$	$+21.7n - 39.1\text{x}10^6$	$-71.6n - 34.5\text{x}10^6$
-45°	$+227n - 409\text{x}10^6$	$+21.7n - 39.1\text{x}10^6$	$+71.6n + 34.5\text{x}10^6$
0°	$+1471n + 189.5\text{x}10^6$	$-52.7n - 74.9\text{x}10^6$	$0n + 0$

Following the procedure outlined by eqs. 9.43 through 9.73 results in the following values of n for each layer and each failure mode:

Table 2: Summary of loads *n* (kN/m) to cause failure in $[\pm 45/0_2]_S$ laminate: Maximum stress criterion

	Failure mode					
Layer	σ_1^C	σ_1^T	σ_2^C	σ_2^T	$-\tau^F_{12}$	$+\tau^F_{12}$
+45°	-3700	+8410	-7410	+4100	+915	-1877
-45°	-3700	+8410	-7410	+4100	-1877	+915
0°	-979	+891	+2370	-2370	$+\infty$	$-\infty$

Failure due to $+N$: $n = +891$ kN/m. Failure is due to tensile stress in the fiber direction in the 0° layers. This is considered a catastrophic failure.
Failure due to $-N$: $n = -979$ kN/m. Failure is due to compressive stress in the fiber direction in the 0° layers. This is also considered a catastrophic failure.