

**Prob. 6.2**

What is the maximum fiber volume fraction  $V_f$  that could be obtained in a unidirectionally reinforced with optimal fiber packing?

Consider a triangular area inscribed on a close-packed section as shown. The enclosed fiber area includes half of the three circles located on the midsides, and one-sixth of the three circles at the vertices. The area of fibers in the triangle is then

$$A[f] := (3 * (1/2) + 3 * (1/6)) * \pi * r^2;$$

$$A_f := 2 \pi r^2$$

The area of the equilateral triangle, with sides of  $4r$ , is

$$A[t] := 4 * r^2 * \text{sqrt}(3);$$

$$A_t := 4 r^2 \sqrt{3}$$

Packing density is then

$$\text{Digits} := 4; p := \text{evalf}(A[f]/A[t]);$$

$$p := .9072$$

