THERMOPLASTIC MATRIX COMPOSITES

Assignment 2-S1

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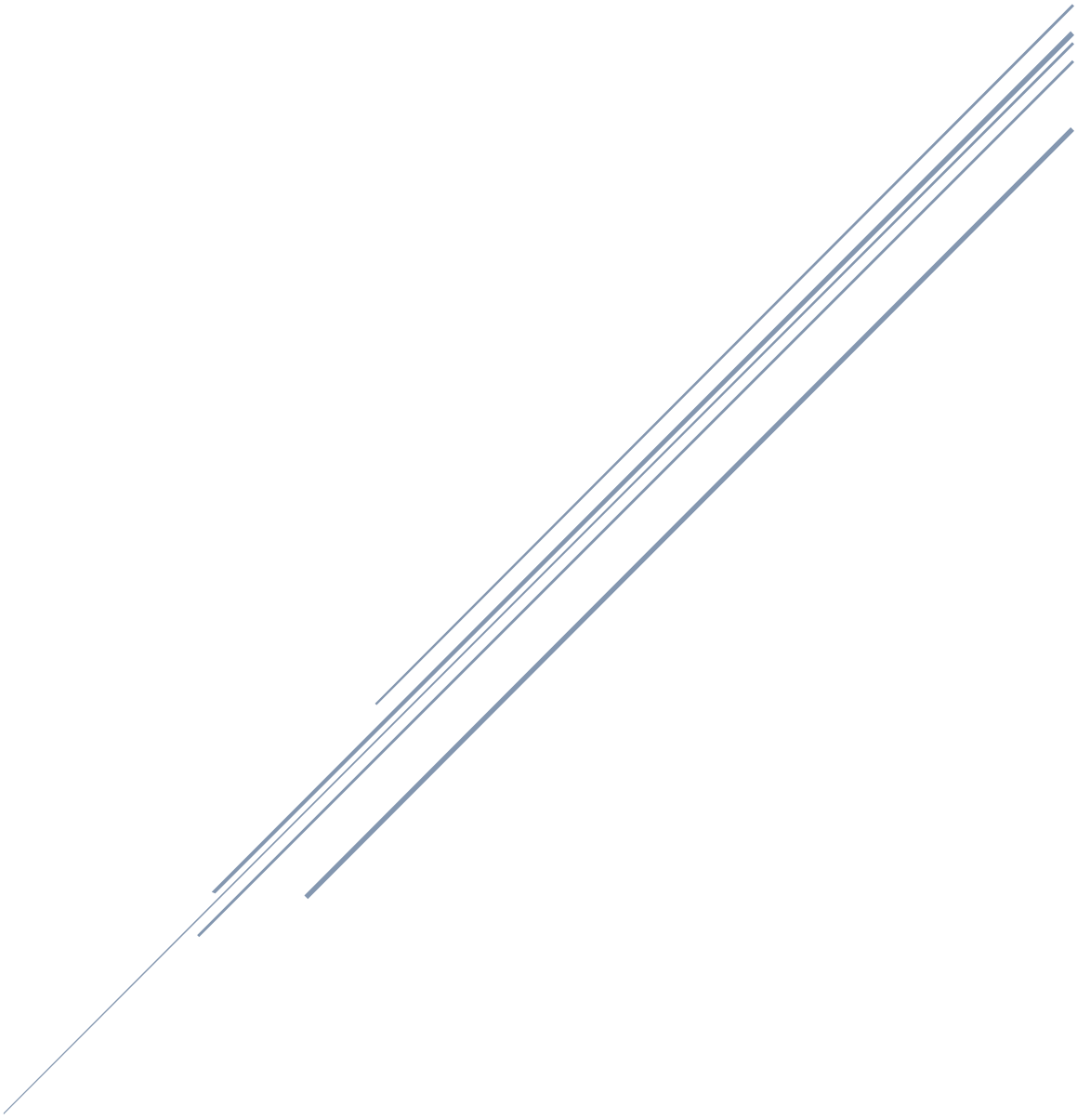
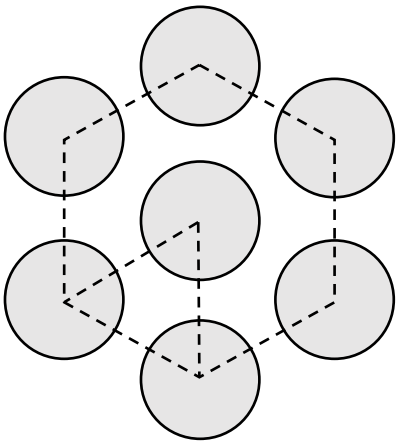
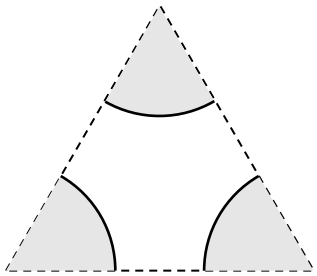


1. Introduction

In this problem, we will study the behavior of a carbon fiber composite with Epoxy matrix where the fibers are arranged in a hexagonal way. We will discuss the effect of the volume fraction of the fibers. The mesh size will be refined to an optimal size

To simplify the problem, we will divide the hexagon into 6 triangles, because of the symmetry.





It will be with this elemental geometry that we will do all our calculus for the rest of the assignment.

To begin the abaqus modelization, we will need the size of the side of the triangle and the radius of the circle.

We now that the area of the equilateral triangle is :

$$A_t = \frac{\sqrt{3}}{4}a^2$$

The angle between each side of the triangle is $\frac{1}{6}\pi$ rad.

So the area of one fiber in this elementary geometry is :

$$A_f = \frac{1}{6}\pi r^2$$

With 3 part of fiber for each geometry we have that :

$$V_f = \frac{3}{6}\pi r^2$$

We can said that :

$$\begin{cases} a = \sqrt{\frac{4}{\sqrt{3}} A_t} \\ r = \sqrt{\frac{2}{\pi}} V_f \end{cases}$$

The unit number here doesn't matter, we are working with $A_t = 100$.

We obtain:

$$\begin{cases} a = 15{,}197 \\ r = \begin{cases} 4{,}37 \; for \; 30\% \rightarrow Alesandro \\ 5{,}64 \; for \; 50\% \rightarrow Erwan \quad of \; fiber \\ 6{,}68 \; for \; 70\% \end{cases} \end{cases}$$

The next step is to create in Abaqus, the materials use. The epoxy matrix is isotropic and easy to