ALPHA MA SILK CALCULATOR GUIDE

The Excel File "Alpha MA silk calculator" allows calculating the value of the α_T* parameter for major ampullate (MA) gland silk fibers. The α_T* parameter classifies any MA fiber by comparing it with a reference curve of supercontracted *Argiope aurantia* MA fibers. The details of the calculation can be found in R. Madurga et al., "Material properties of evolutionary diverse spider silks described by variation in a single structural parameter", Scientific Reports 6:18991 (2016).

Structure of "Alpha MA silk calculator"

The file is composed of three Excel sheets INPUT, Aux and Plot.

The **INPUT** sheet allows introducing the data and yields the value of the α_T* parameter. The file requires four sets of data: length increment, ΔL (mm); Force, F(mN); Initial length, L_0 (mm); and initial area, A_0 (μm^2).

Before starting the introduction of the data, click on "Clear Input Data". The columns ΔL (mm) and F(mN) are cleared out and ready for introducing the experimental data.

The column ΔL (mm) corresponds to the length increment of the fiber during the tensile test, i.e. if L is the instantaneous length of the fiber and L_0 the initial length:

$$\Delta L\ (mm) = L(mm) - L_0(mm)$$

It is important that the initial length, L_0, is such that no load is exerted on the fiber at that length, but forces build up immediately upon stretching.

The column F(mN) corresponds to the force exerted on the fiber at a given value of ΔL(mm). It is important that the initial value is F=0 mN, since this should be the value of the force at L_0.

The initial length of the fiber, L_0, is introduced in cell F5

The initial cross sectional area of the fiber, A_0 (μm^2) is introduced in cell G5.

The value of the α_T* parameter that results from the calculation is displayed in cell F9.

Aux and Plot sheets are intended to provide additional information, but its use is not necessary to obtain the α_T* parameter.

The **Aux** sheet displays:

The Engineering strain, e (column B) and the engineering stress, s (column C) calculated from the INPUT data and defined as:

$$e = \Delta L/L_0 \quad ; \quad s = F/A_0$$

The true strain, ε (column E) and the true stress, σ (column F) calculated from the INPUT data and defined as:

$$\varepsilon = Ln(L/L_o) = Ln(1+e) \quad ; \quad \sigma = F/A = s(1+e)$$

Where A is the instantaneous cross sectional area of the fiber. Calculation of true stress assumes that the volume remains constant during the deformation of the fiber, i.e. $AL = A_0L_0$.

The true strain, ε, of the *Argiope aurantia* reference (column I) and the true stress, σ, of the *Argiope aurantia* reference (column J).

The **Plot** sheet shows the true stress-true strain curve calculated from the INPUT data and displaced with reference to the true stress-true strain *Argiope aurantia* reference. The value of the α_T* parameter can be read off from this plot as the value at which the true stress-true strain curve of the sample touches the true strain, ε, axis.