Equivalent Operating Load

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The formula for determining the equivalent operating load (F_{eq}) is important. Many engineers will just use the nominal operating load (F) when calculating the life of a ball screw but in extreme cases this may neglect some significant loads and forces such as those due to impact, shock, extreme acceleration / deceleration, externally applied loads, etc.

In the example used in the article, I assumed a simple trapezoidal motion profile (See Figure 1) whereas the system was accelerating or decelerating approximately 9% of the time and was at constant velocity for 91% of the time.

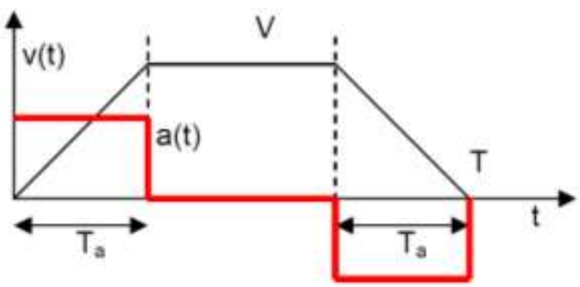

Figure 1 - Trapezoidal Motion Profile

Figure 2 is an excerpt from the engineering section of the Thomson catalog and can be found in most ball screw texts. The equivalent force equation is given as:

$$F_{eq} = \left(\sum_{i=1}^{n} F_i^3 \times \frac{n_i}{n_{eq}} \times \frac{q_i}{100}\right)^{1/3}$$

Where:

F_{eq} = Equivalent Load
n_{eq} = Equivalent Speed
q = percentage of time

Since this is a constant velocity application, we will ignore the equivalent speed term and simplify the equivalent load equation as follows:

$$F_{eq} = \left(\sum_{i=1}^{n} F_i^3 \times \frac{q_i}{100}\right)^{1/3}$$

Solving this equation gives us the final answer of approximately 304 N.

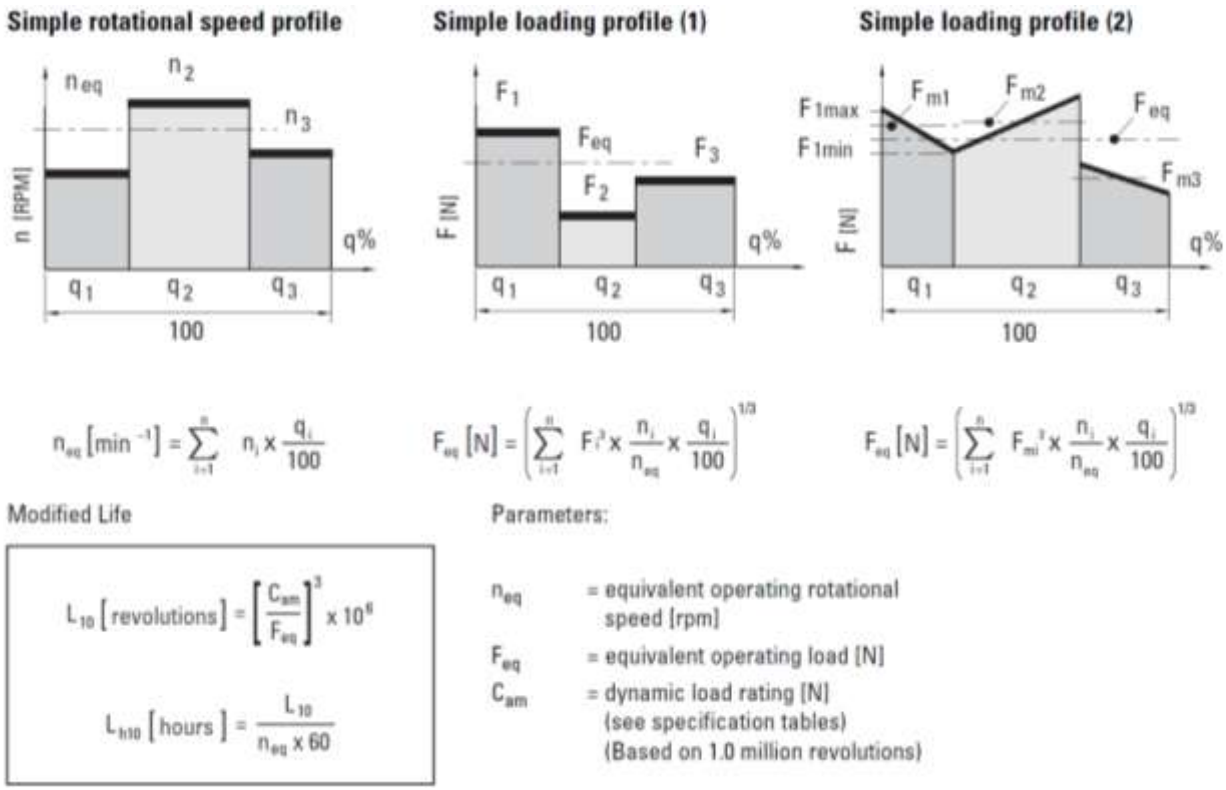

Figure 2 - Equivalent Force Equations