Welcome back to Power Transmission Engineering's Ask the Expert—a new, continuing reader resource for design engineers, component specifiers, systems integrators, quality assurance, maintenance personnel and more. Each issue, our esteemed industry experts will address the every-day—and the more complex—making-things-move challenges that never cease to materialize—from drafting table to factory floor. Have a question? Simply e-mail your question with your name, job title and company name to: Jack McGuinn at: *jmcguinn@powertransmission.com.*

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THE QUESTION

My question is related to the technical article about selecting and sizing ball screw drives in the October 2012 issue of *PTE (page 36)*. When calculating the load on the ball screw, I followed the frictional force and thrust force calculations, but on the last line, *F* (*eq.*) is arrived at without definition (presumably because it is something intuitive). Perhaps, because I'm still fairly new to this stuff, I failed to intuit the calculation correctly. Short form of the question: How'd you get *F* (*eq*)?

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Response provided by Jeff G. Johnson, product engineer, Thomson Industries

The formula for determining the equivalent operating load (F_{eq}) should have been included. 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 (Oct. 2012) article, I assumed a simple trapezoidal motion profile (Fig. 1), whereas the system was accelerating or decelerating approximately 9% of the time and was at constant velocity for 91% of the time.

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:

where

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

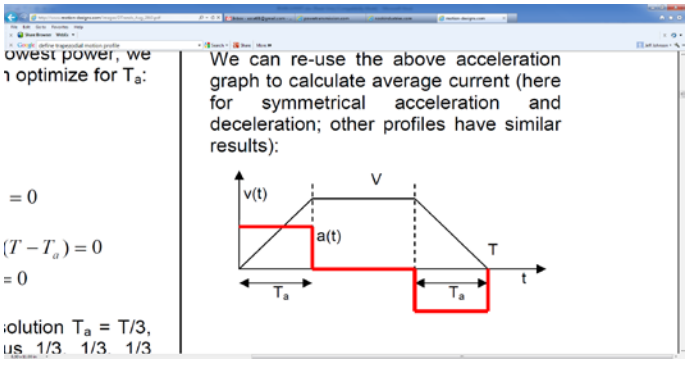

Figure 1 Trapezoidal motion profile.

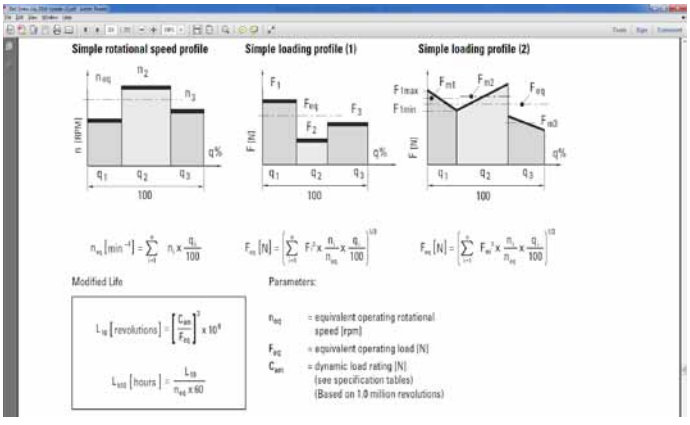

Figure 2 Equivalent force equations.

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

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

Jeff Johnson, product engineer for industrial screws, has been with Thomson for nearly six years. He is responsible for new product development and application support for the NA market, and specializes in ball screws and lead screws.

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