Performing Trade Studies

It is often the case that there are different criterion used to evaluate a system. There are multiple objectives and it is usually not possible to maximize every single one. In this lab, you will perform a very simple trade study using ParaMagic building on top of the previous pendulum model.

Pendulum Clock Tradeoffs

The customer was satisfied with the previous analysis of the pendulum system and was faced with certain questions in constructing the clock. *The cost of the pendulum is 10 dollars per meter.* For shorter pendulums, fewer materials are required and and therefore it is less costly to build.

The customer has devised a drive mechanism that is independent of the length of the pendulum but will power the pendulum over a 4cm window.

Figure 1. Angle of oscillation θ determined by length of pendulum and 4cm drive window.

There are a number of additional requirements that the customer has placed on the system.

- The customer has requested that the pendulum be no taller than 4 meters.
- The customer has indicated that the period of the pendulum must be an integer number of seconds at least 1.

Refer to Chapter 8 of the ParaMagic User's guide to determine how to perform a trade study using Excel. The input parameters will be

- The period of the pendulum.

The output parameters will include

- The cost of the pendulum.
- The error per hour that the pendulum incurs.

Intermediate parameters that will need to be computed include the *length* of the pendulum, the *period* of the pendulum, the *angular amplitude* of the pendulum.

Using Excel, create a plot showing the cost of the pendulum vs the error achieved. We would like to have minimum error and minimum cost. Discuss the results of the plot.