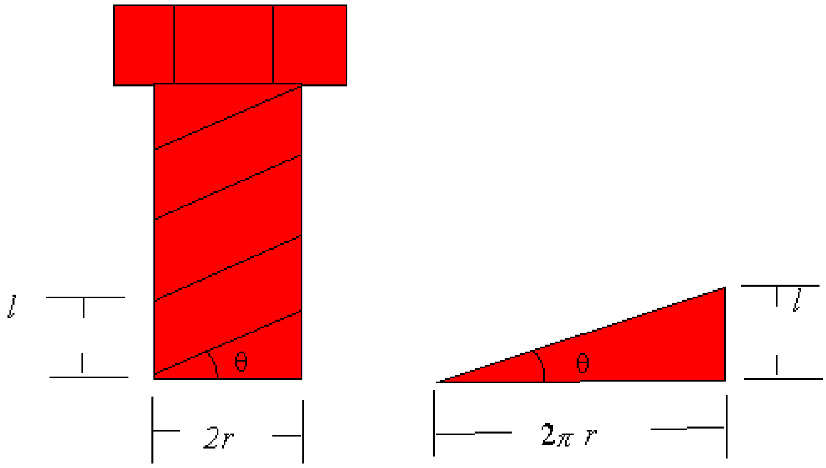
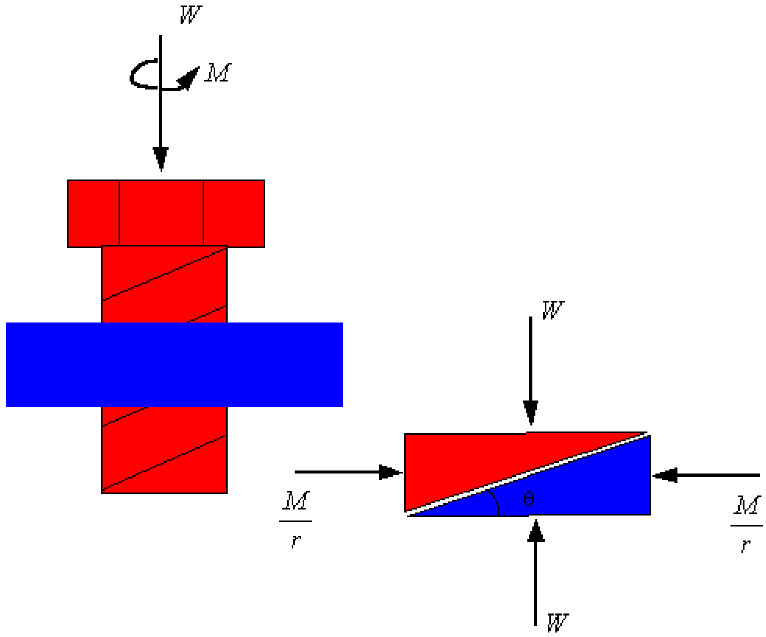
Friction- Part 3:

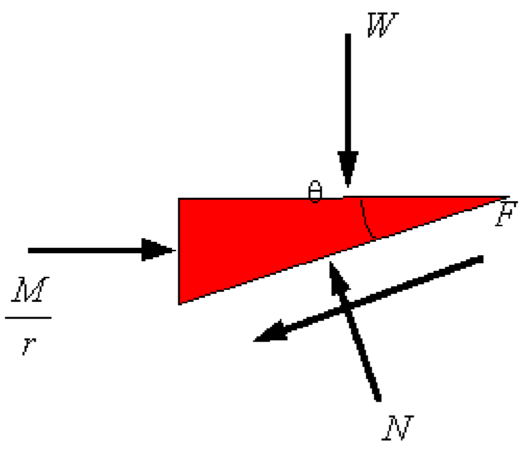
Screws: One can consider a screw and a bolt as a combination of two wedges. One wedge is obtained from opening the helical treads of the screw and the other will come from opening the helical threads of the bolt. For example, if one opens one revolution of the thread of a screw having a lead of l and mean thread diameter $2r$, one gets the following wedge where θ is the lead angle.



Now consider the situation where a screw is in a bolt or threaded hole. In the picture the screw is being pushed into the hole as the screwing moment is trying to unscrew it. Depending on the lead angle, the magnitude of the axial load *W*, and the magnitude of the applied moment *M*, either the axial load will dominate and the screw will move down or the moment will dominate and the screw will move up.



If the axial moment is sufficient to unscrew the screw, then the frictional force will oppose moving up of the screw threads and one will use the free-body diagram a for the wedge. If the axial load is large enough to screw the screw into the bolt, then the frictional force will oppose the downward motion of the screw threads and one must use the free-body diagram b.

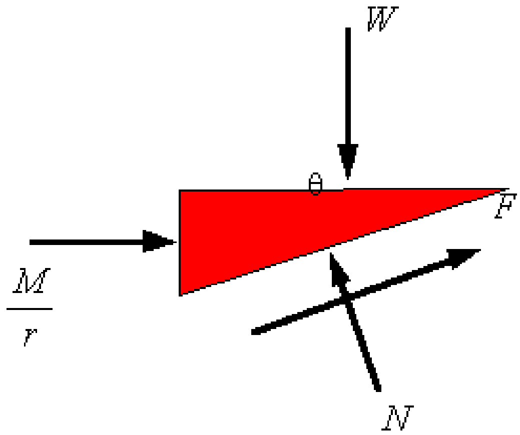


(a)

One can reverse the axial load W to be pulling the screw out or one can reverse the direction of the screwing moment. These cases can be studied in a similar way. If you need to know how much axial force *W* or screwing moment *M* is needed to make the screw turn in a given way, then you assume that the threads are slipping and

$$F = \mu N$$

Take the static coefficient of friction if you need the initial value to get the screw started turning, and take the kinetic coefficient of friction if you would like to know what is needed to keep the screw turning.



(b)