

**FREE BODY DYNAMICS OF A SPINNING CYLINDER WITH PLANAR RESTRAINT  
[AKA: FUN WITH A BARREL]**

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**ABSTRACT**

The dynamic motion of a cylinder with and without end caps is analyzed based on rotation about its center of mass and restrained by a plane normal to the axis passing through its center of mass at an angle  $\alpha$ . For small values of  $\alpha$  the governing equations are simplified and require rotation  $> [\sqrt{(2JWL)}/J_x]$  where  $J$  is the transverse mass moment of inertia and  $J_x$  is about the spinning axis,  $W$  is the weight of the cylinder and  $L$  its length. Comparisons to data are made and some applications are discussed, for example, in micro-gravity, the dynamics become periodic.