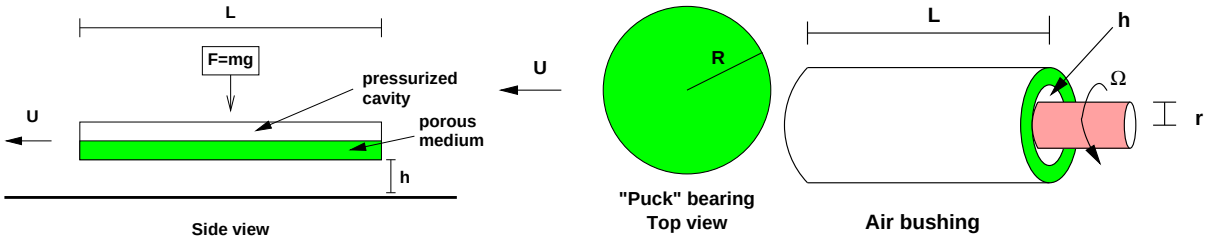
Fundamental properties of porous air bearings.
New Way Precision, Inc.
Aston, PA

New Way Precision located in Aston PA manufactures porous media air-bearings for a variety of industrial applications. The exploration of air-bearings using solid materials is a venerable topic in the MPI workshop. Using porous media for the bearing offers many advantages in practice, but there is a dearth of theoretical knowledge of the performance and behavior.

Traditional airbearings consist of body supported by a thin fluid film in either a static or dynamic configuration. In a static configuration, the flow is forced externally by an imposed pressure gradient. In a dynamic configuration, the body flies over the supporting surface, creating a region of high pressure or lift in the intervening thin film.

The key distinction between the porous media bearing and standard bearings is that the bearing surface is a porous matrix. A cavity behind the surface is pressurized allowing air to flow through the matrix and exit normal to the bearing surface. Of course, $h \ll L$. The system is open so the exterior pressure is atmospheric and the bearing fluid is ordinary air. The properties of the porous material are porosity ϕ, and intrinsic permeability $\mathbf{K}$ and thickness d.



Problems:

1. Determine the drag of a circular "puck" bearing of radius R that is translating over a solid surface given surface finish, speed U, cavity pressure p and load F.

   Typical parameter values are...

2. Given an air bushing operating at high speed (large Ω), model the heat build-up in the narrow gap.