authors and their comments concerning the applicability of this data to current seal analysis techniques, I believe that significant point was overlooked. The friction factor jump phenomenon presented in the paper implies that current analyses are conservative in nature (i.e., the assumed friction factor is less than actual in the vicinity of jumps). This means that the honeycomb seal will leak less and have better rotordynamic stability characteristics than predicted. From an application point of view, this is very good news. Even without the jump phenomena, the accuracy of most seal analysis codes is questionable. Therefore, the degree of conservatism of the prediction becomes an important factor in the design process.

The data presented in the paper are for gas flows only. However, pump manufacturers are investigating applications of honeycomb for incompressible flow seals. Would you recommend using the low Mach number, no jump phenomenon data for those applications?

The authors mention that recent tests with opposed smooth and honeycomb surfaces showed that the resulting friction factor did not lie between the friction factor for either one. However, no mention is made of the jump phenomenon. Did the opposed smooth and honeycomb surfaces exhibit the jump phenomenon?

Several papers have been published by the authors in the past with test data for the rotordynamic coefficients of honeycomb seals. Have the authors reviewed any of that data to determine whether or not a jump in the friction factor was possible based on the honeycomb geometry? If the answer is yes, how did the rotordynamic coefficients change with the jump in friction factor?

Authors' Closure

The interest expressed by Dr. Scharrer in this work is appreciated. Taking the questions in order, our response is as follows:

1) Even though the data presented in the paper are for air flow, the data should be applicable for incompressible flow seals of low Mach number condition. The authors are not aware of any honeycomb seal data for liquid flow.

2) The apposed smooth and honeycomb surfaces also exhibit the jump phenomenon. However, the jump was much attenuated.

3) One of the test conditions given by Kleynhans and Childs (1992) suggests a friction-factor jump result for a smooth rotor/honeycomb-stator seal with a 0.4 mm seal width and 2.29 mm seal depth. Specifically, at 16,000 rpm and 18.3 bar supply pressure, dropping the back pressure (increasing the ΔP) decreased the pressure ratio from 0.67 to 0.4 and resulted in a sharp drop in the cross-coupled stiffness coefficient k. Parallel tests with smooth seals showed no drop in k. So far, this is the only dynamic-seal test result which seems to demonstrate the effects of a friction-factor jump.

Reference

Childs, D. W. and Kleynhans, G. F., 1992, "Experimental Rotordynamic and Leakage Results for Short (L/D = 1/6) Honeycomb and Smooth Annular Pressure Seals," accepted for publication in the *Proceedings of 5th IMECHE International Conference on Vibrations in Rotating Machinery*, Sept. 1992, Bath, England.