



## Air bearing noise analysis

Porous media air bearings provide proven advantages where precision motion or positioning is required. From coordinate measuring machines and precision machine tools to high-speed, precision positioning applications, air bearings are an outstanding solution. In many of these applications, air bearings have a disturbance attenuation effect by removing the physical connection between the machinery and the world and substituting this by a thin layer of air. The isolating property of air bearings can therefore be of great interest. With this regard, the vibration and noise producing characteristics of air bearings are investigated.

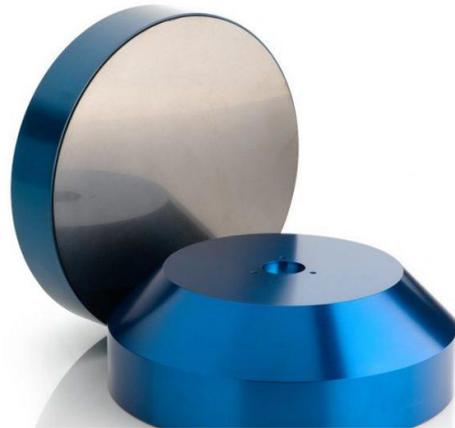


Figure 1: New Way air bearings

In this study we examine the noise characteristic of a 65 mm New Way air bearing. Measurement conditions are a 570N payload and 5 bar operating air pressure, which results in a 4µm air gap and with an air flow of 1.3 SLM.

### Test setup

The air bearing is placed on a smooth granite surface (maximum peak height of 1µm in a range of 7cm) with an approximate load of 570N. A Lion Precision high precision capacitive sensor is used to measure the displacement of the air gap as shown in Figure 2. The measurement is done in two instances, one without pressurized air flowing in the air bearing and the other with an input air pressure of 5 bar controlled with Piezo regulators PRE1-U08 from Aircom. The measurement without air shows the sensor noise level and the measurement with air shows a combination of the sensor noise and air bearing noise. The capacitive sensor was sampled at 10 kHz.

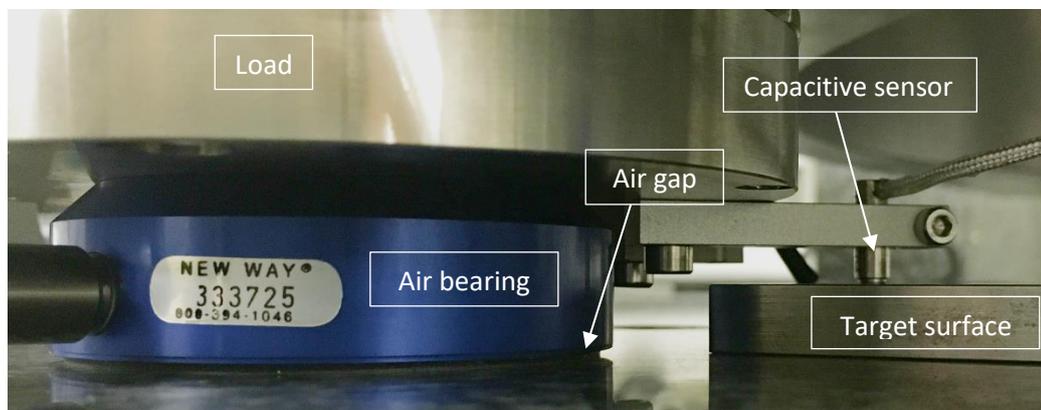


Figure 2 Test setup for noise measurement of New Way 65 mm air bearing

## Test Results

Figure 3 illustrates the results of the experiments for a 2s time interval. The left hand plot depicts the sensor noise when air bearing is not activated (no air) and the right hand side plot shows the displacement after an air pressure of 5 bar is supplied to the air bearing (with air). As can be seen, the filtered sensor noise has a peak to peak variation of around 1nm and an RMS value of 0.17nm whereas the air gap shows a peak to peak value of 2.5nm with an RMS value of 0.32nm.

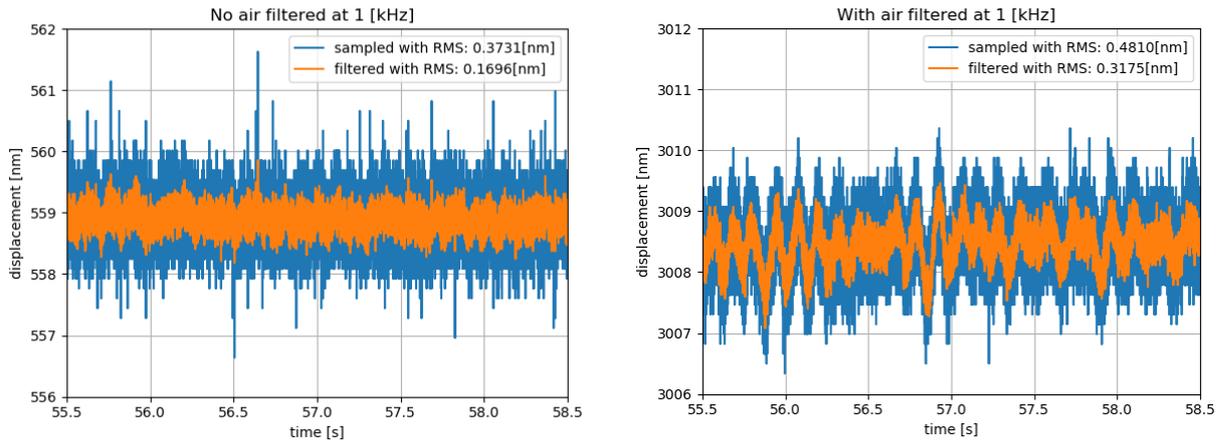


Figure 3, on the left the measurement without any pressured air and on the right the measurement with 5 bar pressure is depicted: the blue plot depicts the raw measurement and the orange plot shows the filtered data using a moving average filter with 1 kHz cut-off frequency.

## Conclusion

In this study we examined the noise characteristic of a 65 mm New Way air bearing under 570 N payload and 5 bar operating air pressure. It was shown that this airbearing achieves an outstanding noise characteristic with a peak to peak value less than 2.5 nm and an RMS value less than 0.32 nm.