

**THE INFLUENCE OF SWIRL BRAKES
AND A LEAKAGE INLET ORIFICE ON
THE ROTORDYNAMIC FORCES GENERATED BY
DISCHARGE-TO-SUCTION LEAKAGE FLOWS
IN CENTRIFUGAL PUMPS**

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PRELIMINARY RESULTS

The following results are presented for a whirl eccentricity of 0.01 inches and a shaft speed of 2000 RPM. Tests are performed with the radial type leakage inlet orifice.

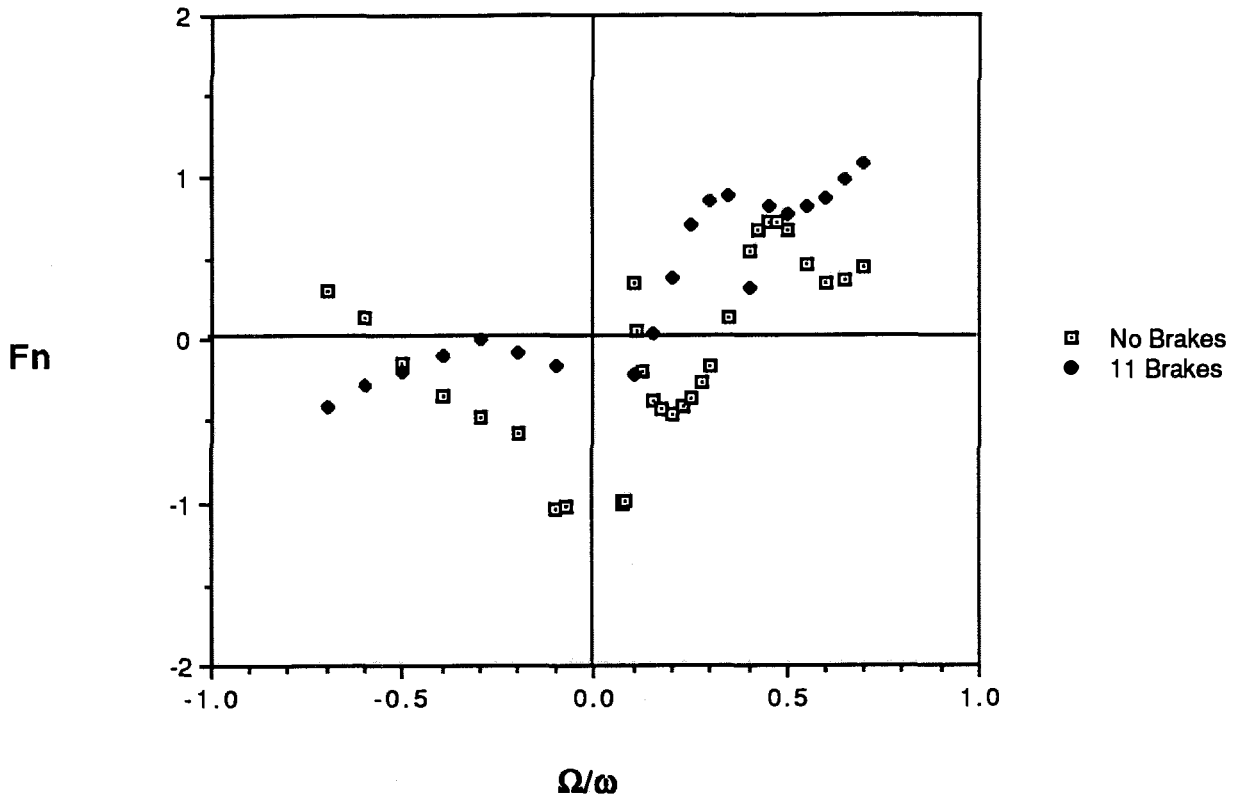
Figure 1 shows the normalized tangential and normal forces for the tests with and without swirl brakes. A wide leakage exit face seal clearance of 0.05 inches was used to remove the effect of the seal. Also, this face seal clearance causes the ratio of the average orifice pressure drop to the overall pressure drop to match the ATD ratio for the case with no brakes. However, when brakes are added this pressure ratio is not maintained. Hence tests were also performed at a smaller face seal clearance of 0.02 inches as shown in Figure 2. This smaller clearance matches the ATD pressure ratio with and without brakes. Comparing the two Figures shows that a tighter face seal clearance has no effect when brakes are used, but has a significant effect without brakes.

For both seal clearances it can be seen that the addition of brakes results in a significant reduction in the cross-coupled stiffness coefficient for the tangential force. Also, the sharp resonance peak in the normal force at a whirl ratio of 0.1 seems to be eliminated by the addition of brakes. However, an undesirable general increase in the normal force occurs over the range of whirl ratios tested. Also for whirl ratios above 0.5 an undesirable increase in the tangential force occurs.

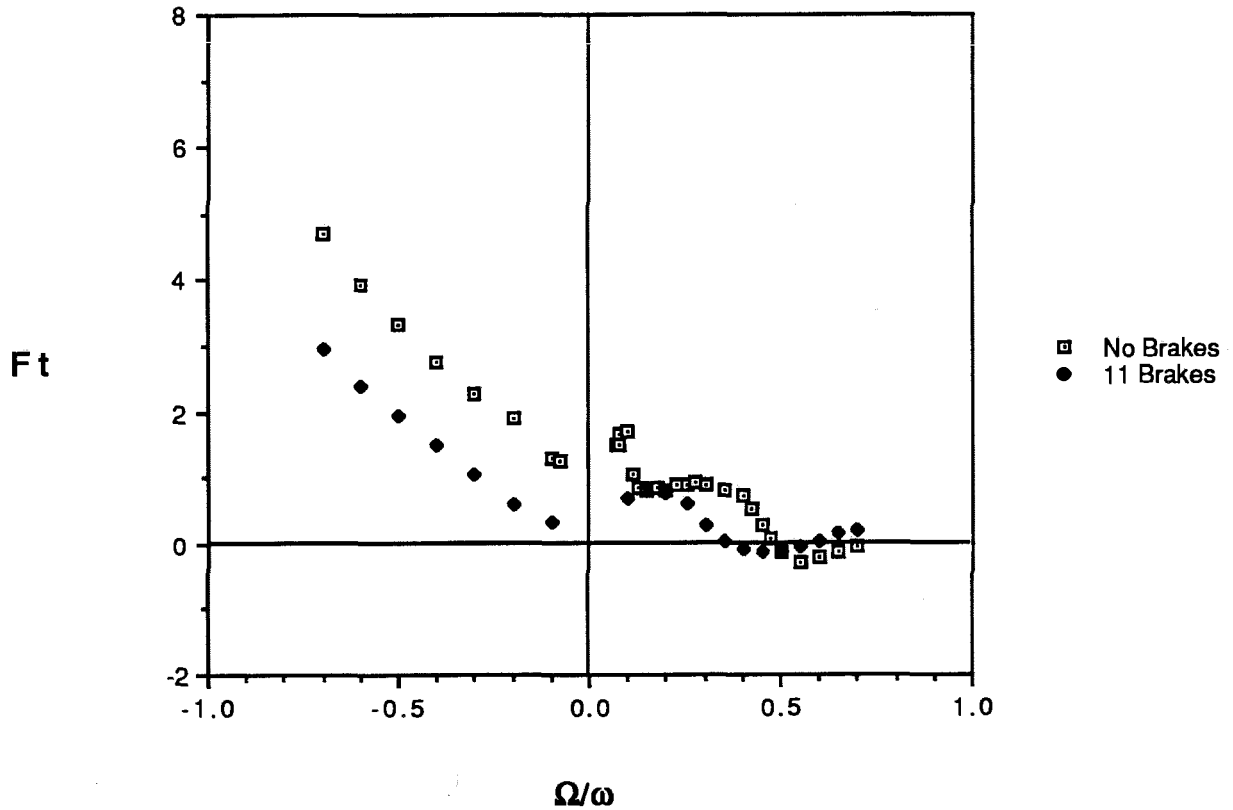
Figure 3 shows the effect of increasing leakage flow rate in the presence of brakes and a wide face seal clearance.

Under the present plan, experiments to test the effect of the addition of swirl brakes without a leakage inlet orifice will be performed next.

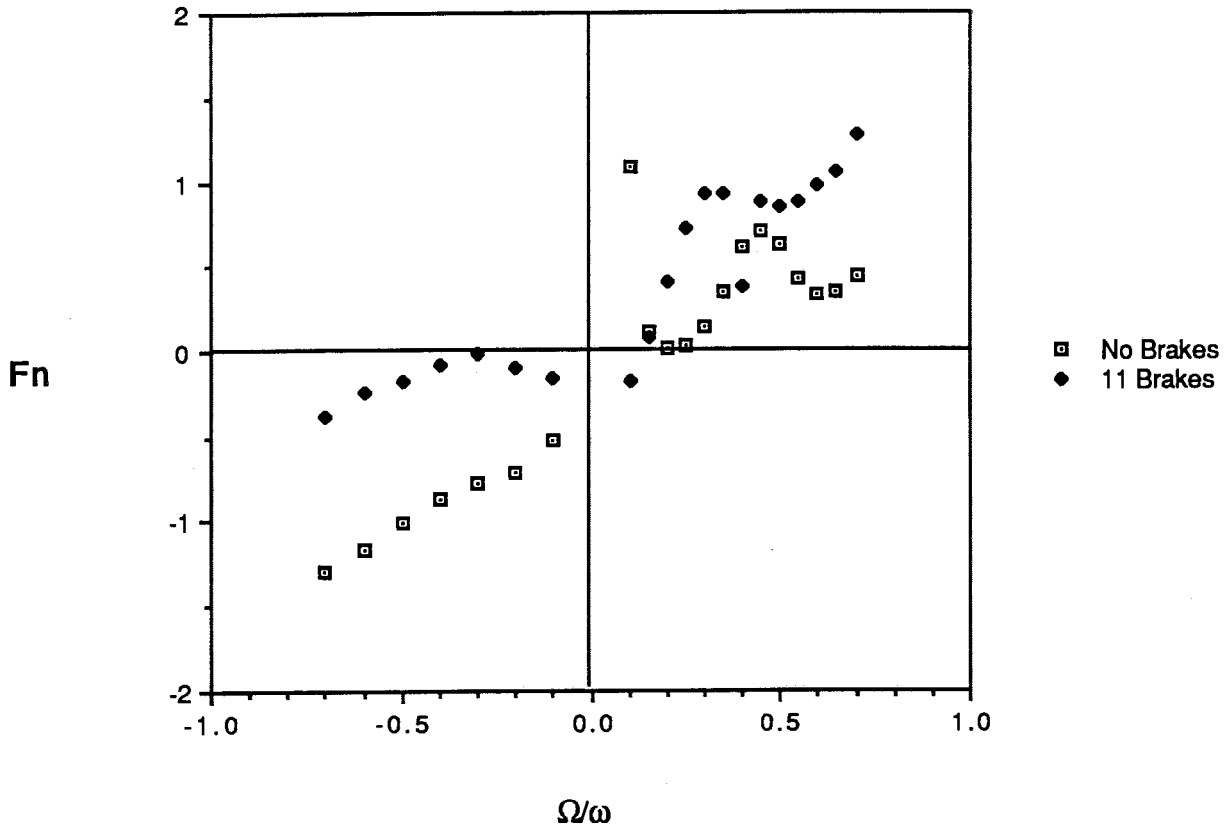
Comparison Plot (Orifice Type 2, 10 GPM)
Face Seal = 0.05 in



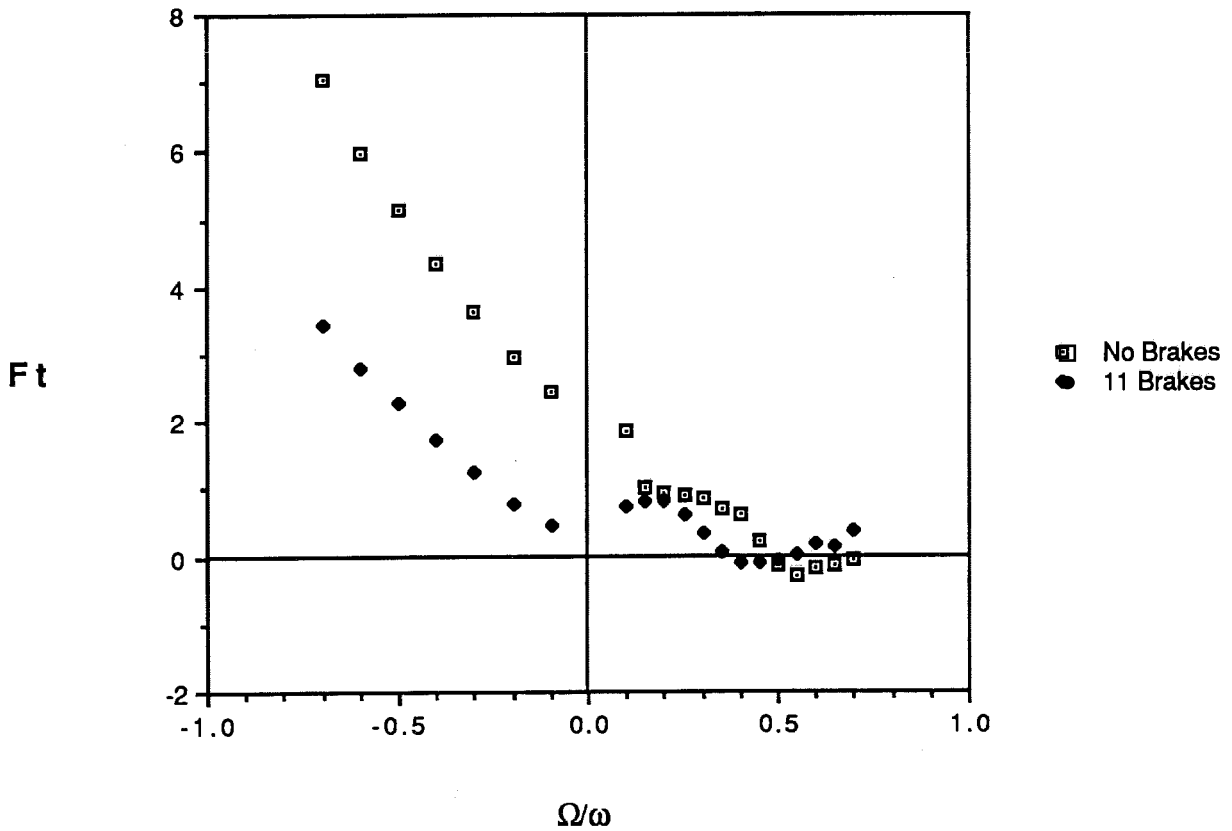
Comparison Plot (Orifice Type 2, 10 GPM)
Face Seal = 0.05 in



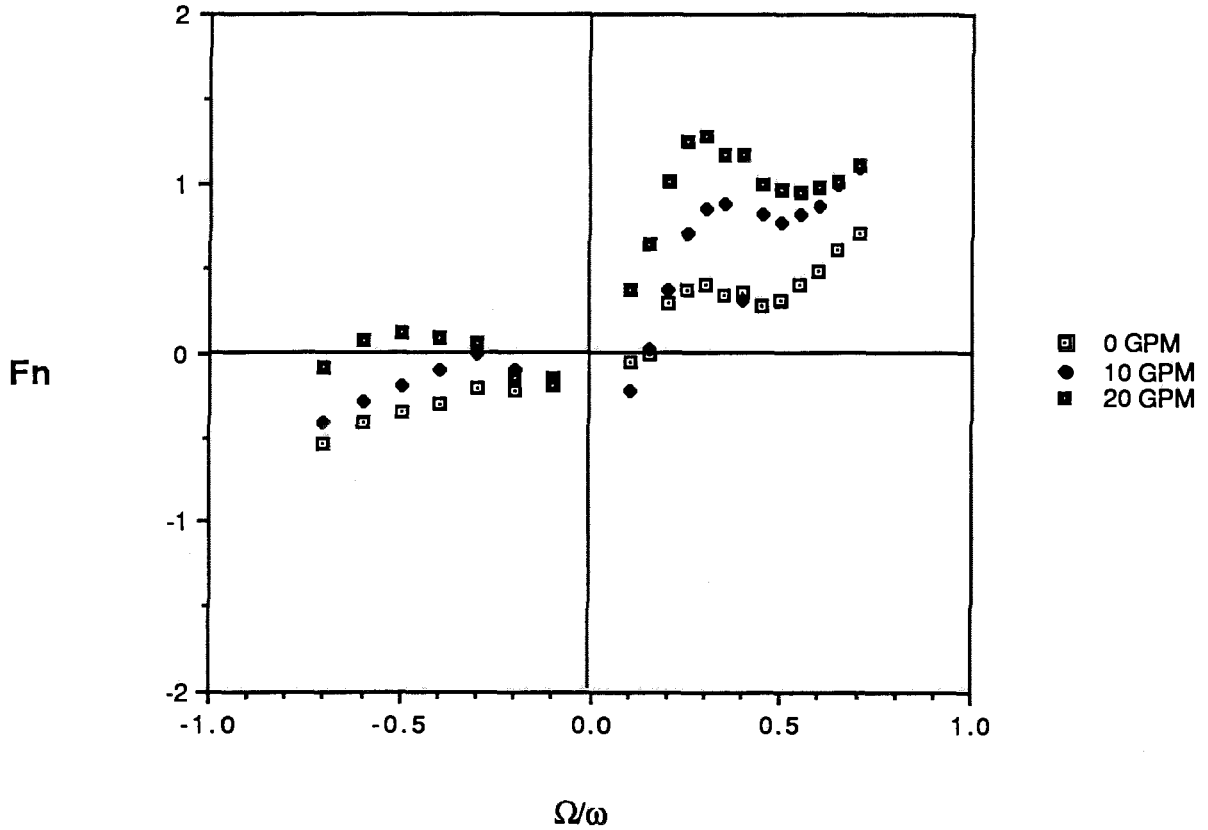
Comparison Plot (Orifice Type 2, 10 GPM)
Face Seal = 0.02 in



Comparison Plot (Orifice Type 2, 10 GPM)
Face Seal = 0.02 in



Orifice Type 2 (H=0.3 in, 11 brakes)
Face Seal = 0.05 in



Orifice Type 2 (H=0.3 in, 11 brakes)
Face Seal = 0.05 in

