



Oil Whirl and Whip

DYNAMICS R4

Alfa-Tranzit Co., Ltd



Rotor Dynamics Simulator



Oil whirl is a common problem with journal bearings used on machines equipped with pressure lubrication systems operating at relatively high speeds.

If the shaft is moved off center due to load, eccentricity, or imbalance, then the clearance on one side of the bearing will be greater than that on the other side.

As the lubricant rotates at less than 50% of shaft speed, it must squeeze through the narrow area where the shaft is closest to the bearing. The average speed of the lubricant increases inside the gap and slows down when it leaves the gap. Such a speeding up and slowing down process creates turbulence on both sides of the gap, and a vortex develops in the high-pressure lubricant zone.

The shaft that rides on the oil vortex performs much like a surfboard that rides the surface of a wave. The so-called oil whirl, whose frequency is somewhat less than half of the shaft rotational speed, causes instability. The oil whirl stays proportional to the shaft frequency and drops out when shaft RPM drops below the instability threshold.

The oil whirl frequency approaches the first critical speed of the shaft as the shaft exceeds more than two times its first critical speed, creating a resonant condition called oil whip. The oil whip frequency remains constant at the first critical speed of the shaft and drops out when shaft frequency drops below two times its first critical speed. Both the phenomena can be severe and result in a penetration of the lubrication film. When this happens, the shaft impacts against the bearing and serious damage may happen.

REFERENCE

Interesting Rotor Dynamics Observations on Oil Whirl and Whip
SpectraQuest Inc.

8205 Hermitage Road Richmond, VA 23228
(804)261-3300 www.spectraquest.com April, 2006

Rotor Dynamics Simulator

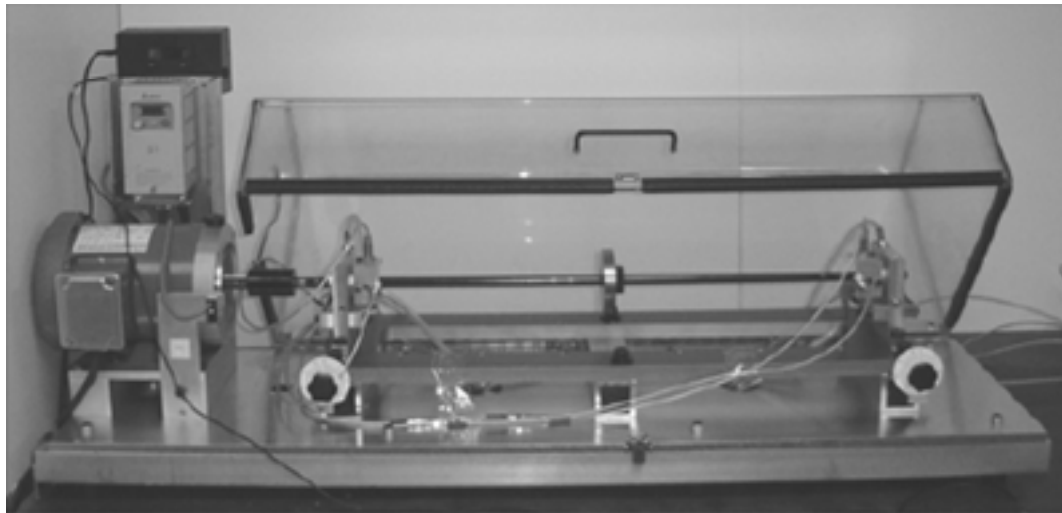
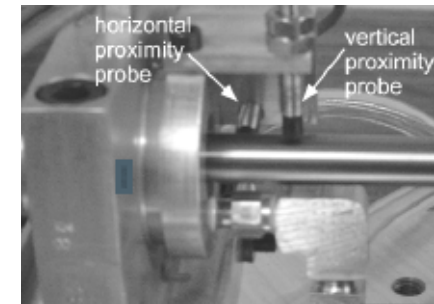


REFERENCE

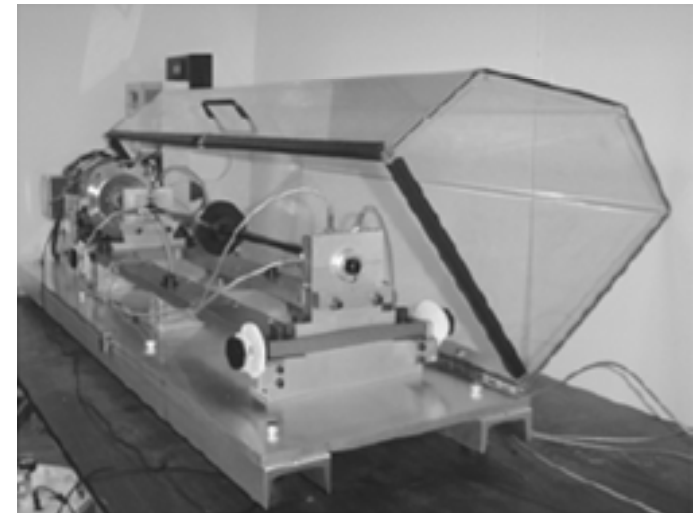
Interesting Rotor Dynamics Observations on Oil Whirl and Whip
SpectraQuest Inc.

8205 Hermitage Road Richmond, VA 23228

(804)261-3300 www.spectraquest.com April, 2006



Front view

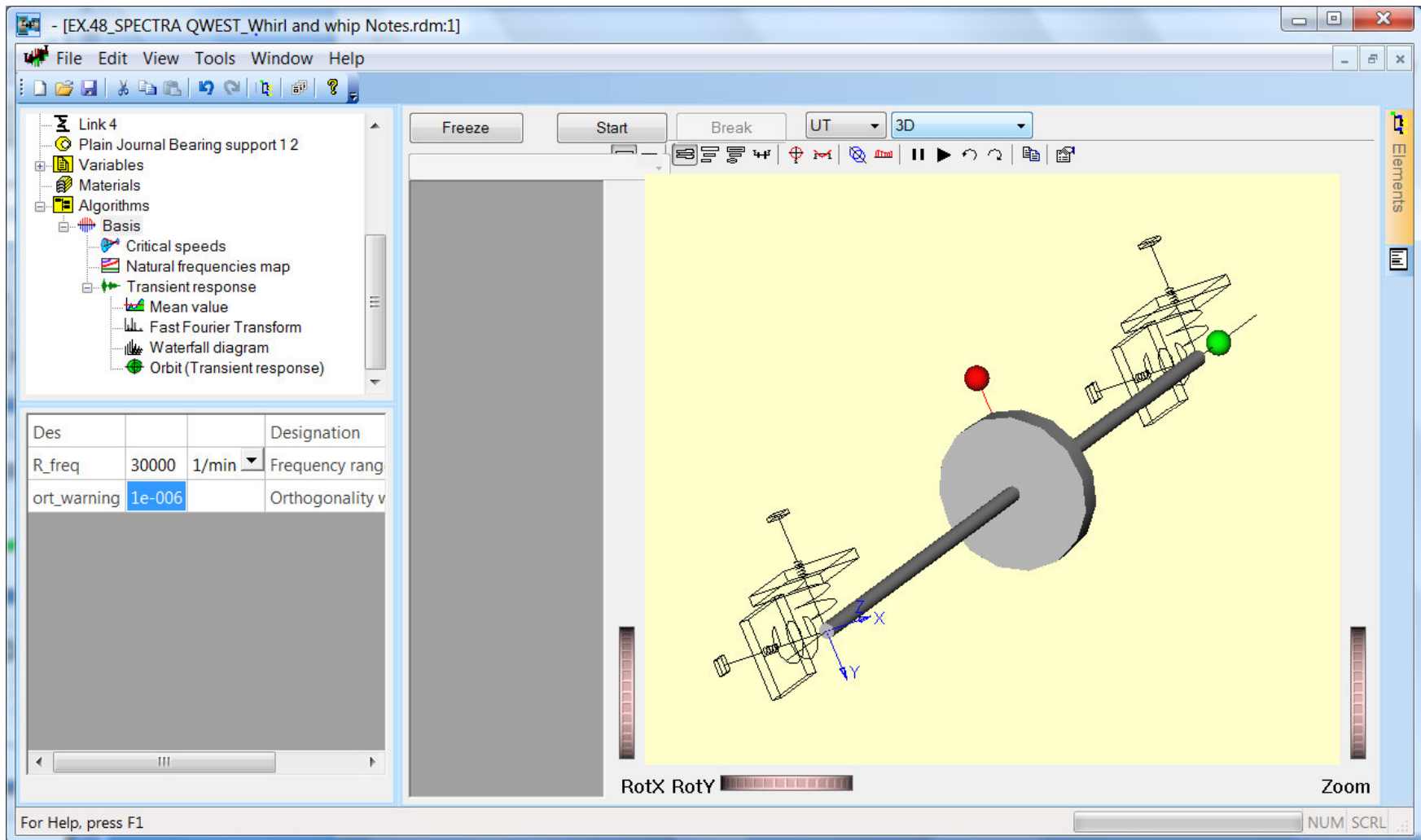


Side view

DYNAMICS R4

Alfa-Tranzit Co., Ltd
(495)232-60-91
www.alfatran.com

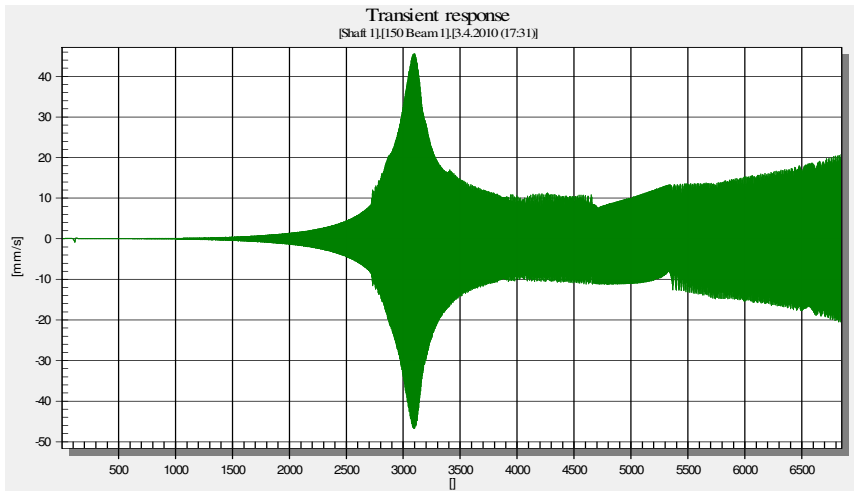
Rotor Dynamics Model



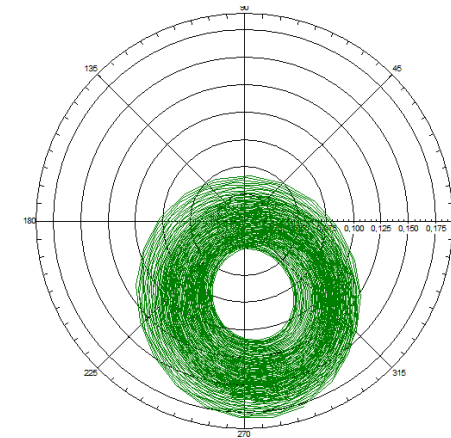
DYNAMICS R4

Alfa-Tranzit Co., Ltd
(495)232-60-91
www.alfatran.com

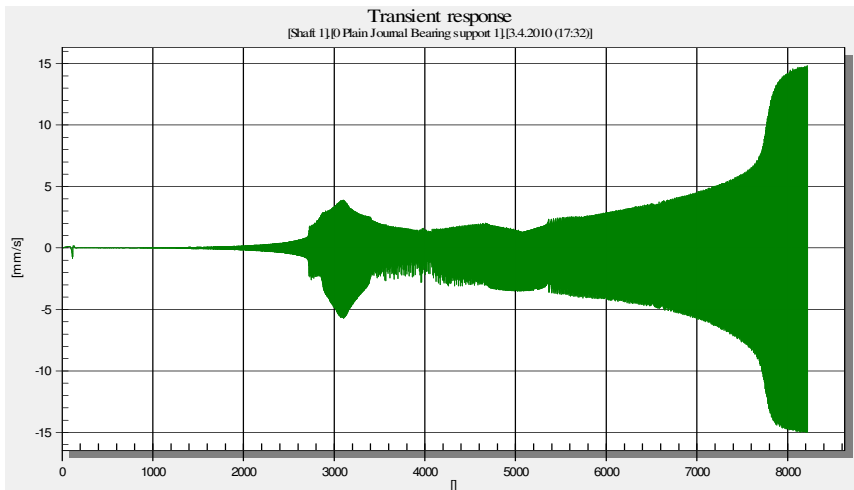
Velocity and Orbit Data (shaft without disk)



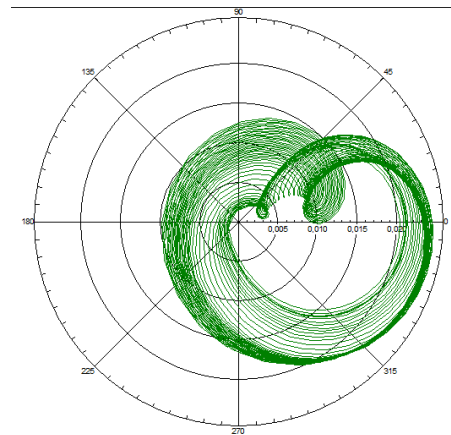
Section of
JB proximity
probe



*Orbit proportional time
interval = 2800...3000 sec*



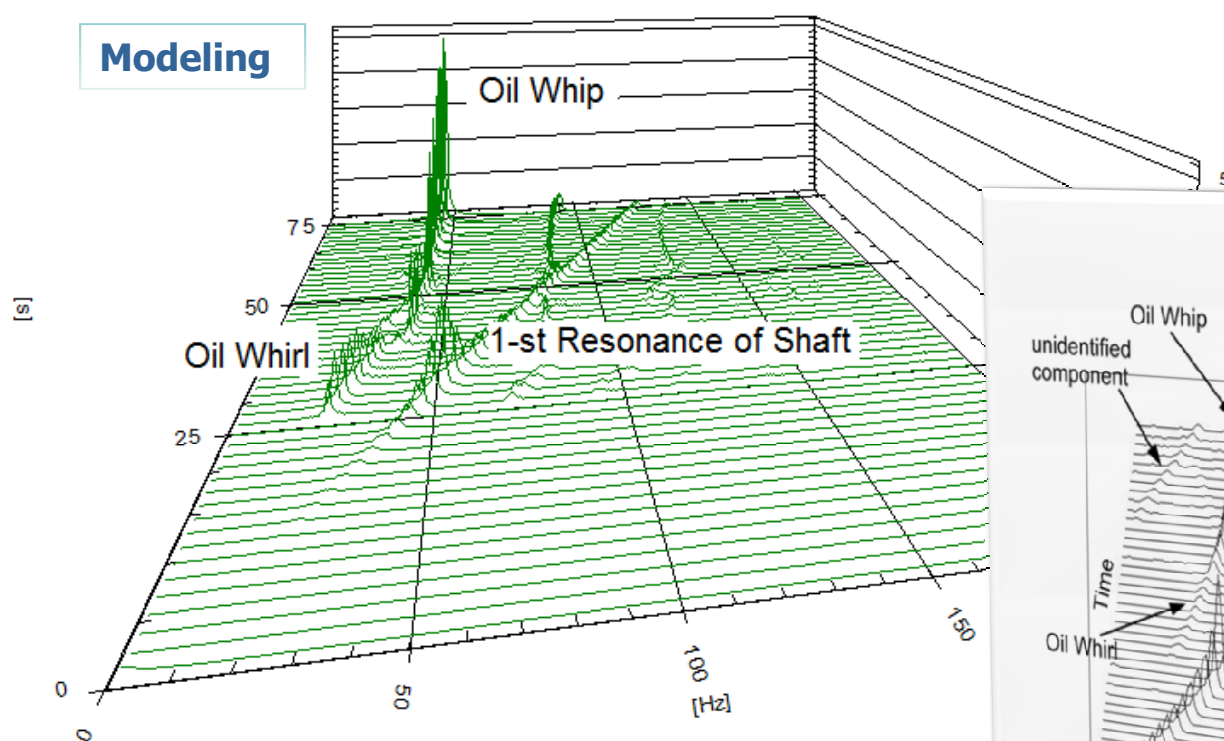
Journal
bearing



Experimental and Modeled Waterfall Plots



Modeling



Qualitative agreement of modeling results with the SpectraQuest Inc. test.

