

Consideration of Whirl Frequency Ratio and Effective Damping Coefficient of Seal

Takuzo Iwatsubo

*Department of Mechanical Engineering
Kobe University, Japan*

Hidetsugu Ishimaru

*Mechanical Engineering Research Center
Hitachi Zosen Corporation*

ABSTRACT

Seal stability is often evaluated by Whirl frequency ratio (WFR) and Effective damping coefficient (C_{eff}) calculated on the assumption of synchronous whirl. However, the natural frequency of the rotor system must be used for calculation of WFR and C_{eff} when determining self-excited vibration. This paper discusses the evaluation of seal stability using WFR and C_{eff} . First, the stability analysis is performed by FEM for a simply supported Jeffcott rotor model, having a seal near the disk. Next, WFR and C_{eff} are calculated for the following two frequencies; (1) the natural frequency of the rotor system, (2) rotational frequency. As the reference of stability, the logarithmic decrement is used for comparing with WFR and C_{eff} .

Effective damping coefficient (C_{eff}) calculated using the natural frequency of the rotor correctly estimates the seal stability. Whirl frequency ratio (WFR) for the natural frequency of the rotor can judge the rotor stability, but cannot evaluate how good the seal is. Both C_{eff} and WFR calculated by using the rotational frequency judge the seal stability wrongly.

Keywords: seal, effective damping coefficient, whirl frequency ratio, seal stability, rotor stability.