

## NON-LINEAR VIBRATIONS IN CRACKED ROTORS

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### ABSTRACT

The influence of a transversal crack in rotating shafts is the focus attention for many researchers due to the fact that the presence of a crack may result in a dangerous and catastrophic effect on the dynamic behaviors of rotating structures and causes serious injuries to rotating machinery. Therefore, the timely detection of a rotor crack would potentially avoid severe damage and expensive repairs due to the failure of rotating machinery as well as assuring the safety of operation personnel. This paper presents a theoretical study of a rotor with a transverse crack and addresses the two distinct issues of the changes in modal properties and the influence of crack breathing on dynamic response during operation. Moreover, the evolutions of the orbits of the cracked rotor near half of the first resonance frequency are investigated. In order to conduct this study, the dynamic response of a rotor with a breathing crack is evaluated by using the Alternate Frequency/Time Domain approach. It is shown that this method evaluates the nonlinear behavior of the rotor system rapidly and efficiently by treating the breathing crack with a truncated Fourier series. The dynamic response obtained by applying this method is compared with that evaluated through numerical integration.

**Keywords:** Rotor, breathing crack, non-linear dynamic