

## Dependence of Shaft Stiffness on the Crack Location

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**Abstract :** In this study, an analytical model is developed to study crack breathing behavior under the effect of crack location and unbalance force. Crack breathing behavior is determined using effectual bending angle by studying the transient change in closed area of the crack. The status of the crack of a balanced shaft is symmetrical about shaft rotational angle and the duration of each crack status remains unchanged. The global stiffness of the balanced shaft is independent of crack location. Different crack breathing behavior for the unbalanced shaft has been observed. The influence of crack location on the unbalanced shaft stiffness can be divided into three regions. When the crack is located between  $0.3L$  and  $0.8335L$ , where  $L$  is the total length of the shaft, the unbalanced shaft is less stiff and when located outside this region it is stiffer than the balanced shaft. It was also found that unbalanced shaft stiffness has a maximum value with a crack at  $0.1946L$ , a minimum value at  $0.8053L$  and same value as balanced shaft at  $0.3L$  and  $0.8335L$ .

**Keywords :** cracked shaft, crack location, shaft stiffness, unbalanced force

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