College: Engineering **Student's Name:** Alaa Muayad Abdul Ameer
Dept.: Mechanical **Supervisor's Name:** Dr. Jaafar Khalaf Ali

Certificate: Master **Specialization:** Applied Mechanics

Title:

Order Tracking Analysis Using Generalized Fourier Transform with Time Dependent Amplitude

Abstract:

The current study aims to develop Time Variant Discrete Fourier Transform (TVDFT) one of Order Tracking Analysis techniques that used to analyse transient (non-stationary) vibration signals. This analysis is very important in separating components of non-stationary vibration signals during acceleration and deceleration (start up and shut down) of rotating machines to identify and diagnose faults in those machines. The development involves overcoming the problems in TVDFT that represented by correlating (smearing) the components of vibration signals when separating closing or crossing orders.

The proposed development in this study was performed by using Generalized Fourier Transform and Polynomial Function of amplitude, where a new matrix was constructed in order to compensate the orthogonality in TVDFT-OT to get rid of its problems.

The new developed method has been programmed in MATLAB and VISUAL BASIC software to investigate of its accuracy and efficiency, and then used to analyze simulated and actual vibration signals.

The transient vibration signal was programmed in MATLAB and the experiments were conducted for obtaining the actual vibration signal. Where the case study has taken the actual transient vibration signal from shaft in acceleration state with shaft in steady state.

The analysis results of simulated and actual vibration signals for the proposed method showed good efficiency in separating vibration components comparing with other methods that were suggested to enhance TVDFT. Also, the results showed that the new method is equivalent to Vold Kalman Filter Order Tracking (VKF-OT) method (which considered the best technique in order tracking analysis methods) in separating the components signal but the proposed method more computational efficient than VKF-OT.