TEXAS A&M ENGINEERING
EXPERIMENT STATION

Turbomachinery Laboratory
Turbomachinery Research Consortium

Software for Torsional Vibration of Machinery Trains with Variable Frequency Drive (VFD) Motors (Starts in 2009) and for Lateral Motor Force Prediction (Starts in 2015)

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Popular Variable frequency drives (VFDs) and motors may induce torsional vibration problem in rotating machinery trains due to the rich harmonics in motor torques from the PWM switching. To accurately predict the mechanical vibration, it is required to model the entire machinery train with coupled electrical and mechanical fields, including power source, power inverter, VFD controller, motor and mechanical system.

Software capable of comprehensive modeling of both mechanical and electrical subsystems is developed for predicting vibration response and life of VFD motor machinery trains. Radial and tangential magnetic forces due to eccentricity are predicted using magnetic equivalent circuit and Maxwell stress tensor method.

Deliverables
Stand-alone VFD System Software
Induction motor modeling and synchronous motor using open-loop control and closed loop control
Mechanical system with torsional and torsional-lateral coupled model
Gear backlash and impact damping
User specified torque load or internally generated by motor
Stress level and life prediction
Long cable effects
Induction Motor Model with Rotor Eccentricity
Radial and tangential magnetic forces are calculated and verified by ANSYS.
Stability criteria is calculated for linearized model.
Nonlinear effects due to eccentric force are illustrated.

Future work
More features added to the VFD software, i.e., user defined initial conditions, and output.
Extension of motor eccentricity/force modeling to other types of motor
Motor parameter optimization
Finite element modeling of motor **magnetic field**
Planetary gear system modeling

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