BIOGRAPHICAL SKETCH

Mr. Zhiyuan Yu received his Bachelor and Master degree in Mechanical Engineering from Dalian University of Technology in 2008 and 2010. He worked as a mechanical engineer for Zhonghua Geotechnical Company from 2010 to 2012. Then he came to US to seek for his Ph.D. degree. His research topics include, kinematics, Burmester theory, curvature theory, gear kinematics and computational mechanics.

EDUCATION

Ph.D., Mechanical Engineering,

Tennessee Tech University, 2012-2017

M.S., Mechanical Engineering,

Dalian University of Technology, 2008-2010

B.S., Mechanical Engineering,

Dalian University of Technology, 2004-2008

College of Engineering

TENNESSEE TECH

The Department of

Mechanical Engineering

Announces the Dissertation Defense

Of

Zhiyuan Yu

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy

March 16th, 2017 at 9:00am

Held at

BRWN 307

Tennessee Tech University, Cookeville

FIELD OF STUDY

Mechanical Engineering

DISSERTATION TOPIC

Gear Curvature Theory

EXAMINING COMMITTEE

Dr. Kwun-Lon Ting (Chairperson, Mechanical Engineering)

Dr. Stephen Canfield (Mechanical Engineering)

Dr. Alexander Shibakov (Mathematics)

Dr. ChaBum Lee (Mechanical Engineering)

Dr. Yung-Way Liu (Mathematics)

ABSTRACT

Gears are essential to the global economy. Gears are used in nearly all applications where power transmission is required, such as SUVs, heavy trucks, helicopters, and marine vessels.

This research established the gear curvature theory for a three rigid body system. Tracing a random selected point's trajectories under the three rigid body's pure rolling with coincident instant centers generates two curves. Such curves are conjugate to each other, which can be used as tooth profiles for gears in order to transmit a smooth motion with no extra clearance or interference. The generating point's location will decide the conjugate curves' relative curvature, which will further decide the pair of gears' Hertzian contact stress. The gear curvature theory offers a systematic methodology to locate all the possible generating points in order to find new conjugate curves with desired Hertzian contact stress.

Gear tooth profiles with lower contact stress and larger load carrying capacity can be found in less design iteration, comparing with traditional tooth contact analysis. The gear curvature theory can be used to design tooth profiles for different types of gears, such as spur gear, non-circular gear, bevel gear, and spiral bevel gear. Applications in gearing and rotor pump are offered to prove and verify the gear curvature theory.