



**CURSOS FORMACION CONTINUA PGA**  
(Certificado por la Universidad Politécnica de Madrid)



**Prof. Young-Hoo Kwon**

Ph.D. in Exercise & Sport Science with specialization in Biomechanics and minor in Mechanical Engineering, Pennsylvania State University, University Park, PA.

Professor, Dept. of Kinesiology & Director, Biomechanics Laboratory, Texas Woman's University, Denton, TX

Editor, Sports Biomechanics

Vice President of Publications, International Society of Biomechanics in Sports.

Research interest in 3D analysis and forces applied in golf swing.

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**October 26. Foot-ground interaction in golf.**

1. Moment of force (torque)
  - Eccentric force
  - Moment arm and torque
  - Importance of moment arm
2. Ground reaction force (GRF) and moment (GRM)
  - GRF, GRM, and center of pressure (COP)
  - Individual vs. combined
  - Pressure mat vs. force plate
3. Newton's equations of motion
  - Meaningful external forces in golf swing
  - Importance of GRF/GRM
4. Moments produced through foot-ground interaction
  - GRF moment
  - Pivoting moment
5. Meaningful peak moments
  - Frontal-plane GRF moment
  - Transverse-plane pivoting moment
  - Roles of the lead and trail legs in generating moments
  - Different swing styles
  - Various cases
6. Implications
  - Role of foot-ground interaction in golf
  - Unbalanced foot-ground interaction
  - Importance of pelvis/leg motions



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### **Prof. Sasho Mackenzie**

PhD in Sports Biomechanics at the University of Saskatchewan, which focused on 3D forward dynamics simulation of the golf swing. He is currently an associate professor in the Department of Human Kinetics at St. Francis Xavier University and his research interests lie in the optimization of human movement with a strong emphasis on sport performance. His research encompasses both optimal sport movement patterns as well as the most advantageous training techniques. He has conducted, presented, and published research on putting, shaft dynamics, 3D mechanics of the swing, shoe fitting, and the role of center of pressure in the golf swing. He has consulted for several entities in the golf industry including Ping, Footjoy, Boditrak, Kvest, and FlightScope as well as for several top instructors such as Chris Como.



### **October 26. Forces Applied During the Swing.**

1. Understanding how the golfer translates the club using Newton's Laws
  - Animations of force and velocity vectors during the linear motion of a golf club
2. Understanding how the golfer rotates the club using Newton's Laws
  - Animation of torque vectors acting during simplified motion of a golf club.
  - Explanation of how the golfer uses forces to generate torques.
    - What are force couples and how does a golfer generate them at the grip?
    - What is a moment of force and how does it contribute to the total torque?
3. Moving beyond the concepts of Centripetal and Centrifugal to understand club motion
  - Simple forward dynamics simulations showing the forces and torques during an optimized swing
  - The kinetics behind an efficient kinematic sequence

### **October 27. Forces Applied During the Swing: Application**

1. Describing the kinetics using a swing plane based reference system. The "IN, OUT, and ABOUT" convention
  - In the plane torques – torques that tend to rotate the club with-in the swing plane
    - How a golfer generates the in-plane force couple
    - How a golfer uses the net force to generate an in-plane torque
  - Out of the plane torques – torques that tend to rotate the club out of the swing plane
    - How a golfer generates the out-of-plane force couple
    - How a golfer uses the net force to generate an out-of-plane torque
  - About the shaft torques – torques that tend to twist the club about its own long axis
    - How a golfer generates the about-the-shaft force couple
    - How a golfer use the net force to generate an about-the-shaft torque
2. Application of the above perspective to understand good and bad swing techniques
  - The kinetics of casting versus creating lag
  - The kinetics of an over-the-top move versus slotting the club



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**Rob Houlding.**

Rob is a full time golf instructor and coach following his passion for helping others enjoy the game. Over the past 23 years Rob has become recognized around the world for his innovative approaches to player development and for sharing his work freely with other teachers to advance the profession. Rob has a strong interest in advanced player development techniques and in decreasing the learning time of players. This pursuit for better methods has led him to study areas of motor learning and biomechanics as it relates to the game of golf. In 2014 Rob was recognized by the PGA of Canada as their National Teacher of the Year.

Website - [www.robhouldinggolf.ca](http://www.robhouldinggolf.ca)

Facebook - [facebook.com/robhouldinggolf](https://facebook.com/robhouldinggolf)



**October 26. Techniques for Developing Efficient Forces**

1. Mechanical Concepts - Hand Paths and club head Forces
  - Alpha force
  - Beta force
  - club com
  - Direction of forces
2. Forces being applied to the club and being applied back to the golfer
  - Newton's 3rd law - action and reaction
  - grip
  - tension
  - hand and joint angles
  - shoulder torso movement
  - ground forces
  - direction of forces
3. Creating stability and speed
  - Transfer from feet(GRF) pelvis, trunk to shoulders
  - Developing good ground reaction force
  - COP and CCOP in action
  - Pressure mat patterns- video
4. Mental Concepts
  - Creating Conditions that require the player to react and learn
  - Using the players forces to force the coordination and feel
  - Self Organized Learning concepts (SOL) and guiding discovery

**October 27. Techniques for Developing Efficient Forces: Applications on the Range (Rob Houlding and Young-Hoo Kwon)**

1. Segment and Whole Body coordination screens- where to begin- 20 minutes
2. The Houlding Drills – how to develop better movement and efficient forces - 60 minutes)
  - Concept Drills-
  - Rope drill
  - Open Hands Drill
  - Lead Arm and release Drills
  - Upper to lower coordination development waist high to waist high
  - Timing and rhythm drills
  - Power and Speed development drills
3. Using resistance (counter force) to help the player FEEL how to engage the system efficiently 20 minutes
4. Open Question Period on how to solve common issues with live Demos –20 minutes