

Biomechanical Assessments (Draft Pitchers) Logan Kniss

Assessments:

- **3D Motion Capture** – This analysis is done using 3D markers that are placed on the body and tracked using motion capture systems such as OptiTrack. The markers give us a comprehensive view of a pitcher's mechanics by creating a 3D model and providing insightful data such as kinematic angles, velocity, and positions of the player's motion. These datasets become crucial in identifying any inefficient movements, mechanical flaws, or potential injury risks. This information will be valuable in guiding the pitchers through personalized training programs to improve their performance and longevity.
- **Joint Torque & Force Analysis** – Combined with the motion capture assessment, force plates capture measurements of ground reaction forces during the pitching motion and during specific types of jumps. By analyzing joint torque and force, we can identify any areas of excessive stress in NM (newton meters), which will guide the coaches in developing personalized strength and conditioning programs to mitigate injury risks and enhance overall performance.
- **Pitch Arsenal Analysis** - Understanding the characteristics of each pitch type helps optimize pitch selection and sequencing. By using radar guns and pitch design tools such as TrackMan, Rapsodo, and Edgerronic cameras we can analyze each pitcher's pitch characteristics (spin rate, horizontal/vertical break, and direction of spin) and tailor individualized pitch development plans, helping pitchers refine their repertoire, exploit hitters' weaknesses, and maximize their effectiveness on the mound.

Key Data Points:

Maximum COG Velocity (m/s) –

COG velocity measures how fast a pitcher is moving down the mound. Pitchers who have a fast cog velo is typically because their lower body mechanics are very efficient leading them to have a good lead leg back and thus throw very hard. Therefore I believe this datapoint is important to know generally.

Max Hip Shoulder Separation(hss) –

HSS is the measurement from the hipline to the shoulder line in degrees and peaks around foot plant. This measurement is a representation of the amount of separation pitcher has to close. Typically, guys who have high max hss also throw very hard and with “less effort” resulting in minimal unwanted levels of stress on the elbow joints.

Spin Rate (rpm) –

The number of times a ball rotates on its axis is called spin rate. High spin rate pitches consist of fastballs, curveballs, and sliders. High spin rate is important because it tells the tale of how long a pitch will stay on its plane. A hitter's eye can only register vertical and horizontal depth, therefore the more spin a fastball has = the less time a hitter has to see the pitch.

Notes:

The dataset was familiar to work with, although the challenge was creating a singular DataFrame to analyze based on averages. All the sets had different number of frames which made it difficult to find a start-stop time of the pitching motion. The only other challenge would be no labels, which I had assumed that data such as ‘elbow flexion’ was in degrees.