



# Golf Ball Impact Analysis

Golf has become a very popular sport, and the evolution of golf balls has come far—from feather-stuffed balls to modern resin and polyurethane covered balls with high durability. Modern balls are made of highly compressive materials specifically designed to transfer energy efficiently from the drive to the ball. Understanding the deformation and recovery in the microsecond of impact is crucial for optimizing material composition and performance.

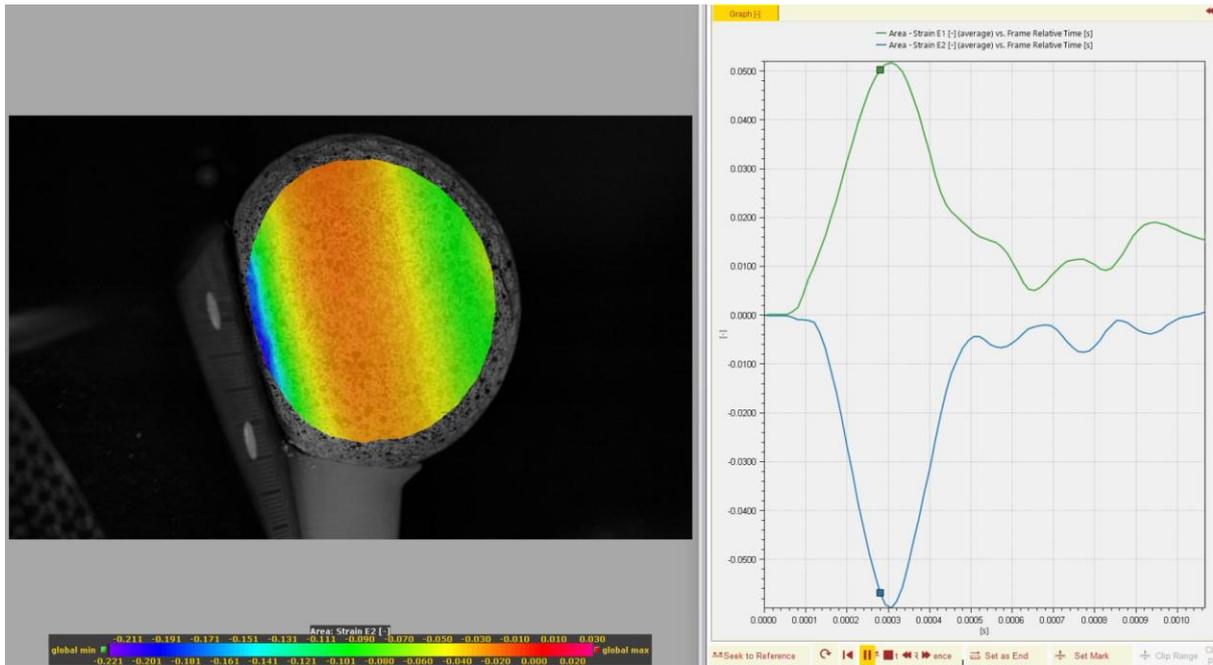
## Objective

The aim of this study was to evaluate **full-field displacement and strain data** during a golf stroke. Using Digital Image Correlation (DIC), the test provided detailed, non-contact insight into energy transfer and the compressive behavior of the material at ultra-high speed.

## Description of the Case Study

A standard-sized golf ball was prepared with a stochastic surface pattern and subjected to a golf swing representative of an average golf player. To successfully capture the event, which lasts only a few hundred microseconds, the test was performed using a single, ultra-high-speed **Phantom TMX 7510 camera**. The camera was configured to capture the event at an ultra-high speed of **76,000 frames per second (fps)**. The captured image sequence was then processed using our **Mercury RT®** software for 2D DIC analysis.





## Results

The Mercury RT DIC analysis successfully converted the high-speed image sequence into quantitative engineering data, revealing the full mechanical story of the impact:

- ❖ **Strain Distribution Maps:** The analysis produced precise, color-coded maps showing the **full-field strain distribution** across the ball's surface at the moment of peak compression.
- ❖ **Displacement & Recovery:** The data quantified the extreme transient displacement and the rapid, elastic recovery of the material, providing a direct metric for evaluating the material's energy transfer efficiency.
- ❖ **Data Validation:** The resulting data is invaluable for validating material models and Finite Element Analysis (FEA) simulations used in the design process.

## Advantages of Using DIC and High-Speed Camera

The successful execution of this case study highlights the definitive advantages of using integrated high-speed DIC:

- ❖ **Non-Contact Measurement** – Measures the entire field of view without physically interfering with the test specimen.
- ❖ **Full-Field Insights** – Captures complete strain and displacement maps, identifying critical stress points missed by single-point sensors.
- ❖ **High-speed motion capture** – High-speed integration captures microsecond events, providing the necessary data for high-strain-rate calculations.
- ❖ **Post-processing capabilities** – reanalyze recorded footage for deeper insights.

## Conclusion

The golf ball impact analysis definitively demonstrates the precision and speed of Mercury RT 2D DIC combined with ultra-high-speed imaging. Although this case study focuses on a golf ball, the same technique is the gold standard for dynamic testing and is expected to be applied to parts and components in demanding industries such as **automotive (crash safety), aerospace (impact damage), defense, and materials science**, wherever a deep, quantitative understanding of dynamic deformation is essential.

