

Golf is a puzzle without an answer – or is it?

Golf club dynamics revealed with the MPV-800 Multipoint Vibrometer



Gary Player, the South African golf legend and one of the best players in history, once stated that golf is a puzzle without an answer. Even after 40 years of playing, he still didn't have the slightest idea of how to play. Today, non-contact and synchronous multi-channel vibration measurement can't come close to capturing the magic of a hole-in-one; however, we can begin to understand the magic moment of hitting the ball.

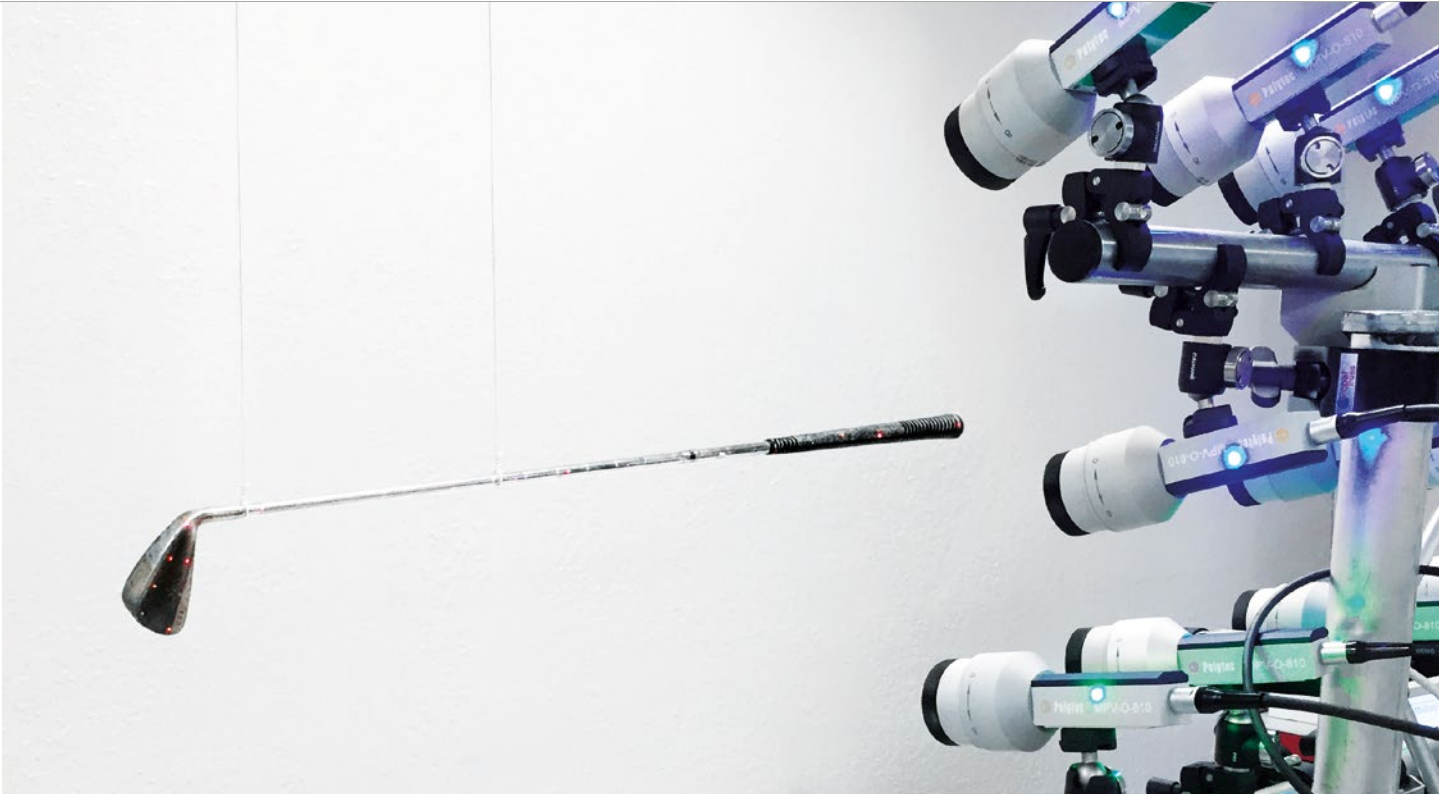


Figure 1: Measurement setup using a 24 channel MPV-800 Multipoint Vibrometer to simultaneously gather vibration data from the entire 9-iron. The red spots are from the laser beams reflecting from their measurement point.

Golf clubs come in a variety of different types. Drivers are designed to generate distance, wedges to lift the ball out of difficult situations, and putters to gently place the ball in the hole. Golf club manufacturers are constantly pushing their club technology to achieve an edge over their competition with new designs that need to be experimentally analyzed and verified. One critical feature of a golf club is how it responds when the club impacts the ball. This response will affect the movement of the ball and the feel in the hands of the golfer.

Polytec's MPV-800 Multipoint Vibrometer uses lasers to capture dynamic response data at up to 48 measurement points simultaneously. Vibration can be captured at up to 16 measurement points when resolving the complete 3D motion. The MPV-800 was designed to capture the complete transient response to a single event, such as a golf ball impacting the head of a golf club.

Some club designs are more forgiving to poorly striking the ball than others, so the exact point of

impact can affect its response and a small deviation may change how that club responds. Therefore, it is important in these tests to strike the club only once and to capture data simultaneously. We tested a 9-iron and a putter with the MPV-800 Multipoint Vibrometer system and excited both clubs manually with single hits in our laboratory. The frequency response of the measurement data shows the fundamental bending mode as well as subsequent modes of the shaft of the 9-iron. In Figure 3, the results of 1.5 seconds of simulta-▶

Figure 2: The putter that was tested is shown here with 24 laser measurement spots clearly visible.



neous, 24 channel vibrometer data after ball impact are displayed by six different deflection shapes at six frequencies. The head of the golf club is seen rotating at approximately 5.4 Hz and higher frequency waves are seen traveling through the shaft.

The test setup used 24 measurement points aligned to cover the shaft and head of the putter. The response due to the im-

pact of the single hit is measured simultaneously for all points. The frequency response of the measurement data shows the fundamental bending mode as well as subsequent modes of the shaft of the putter (Figure 4).

Such deeper understanding of the dynamic behavior, resolved both in frequency and time, helps engineers around the globe to improve their product development.

As stated before, laser vibrometry does not claim to answer the whole puzzle of golf, but like golfers know “the harder you practice, the luckier you get”. ■

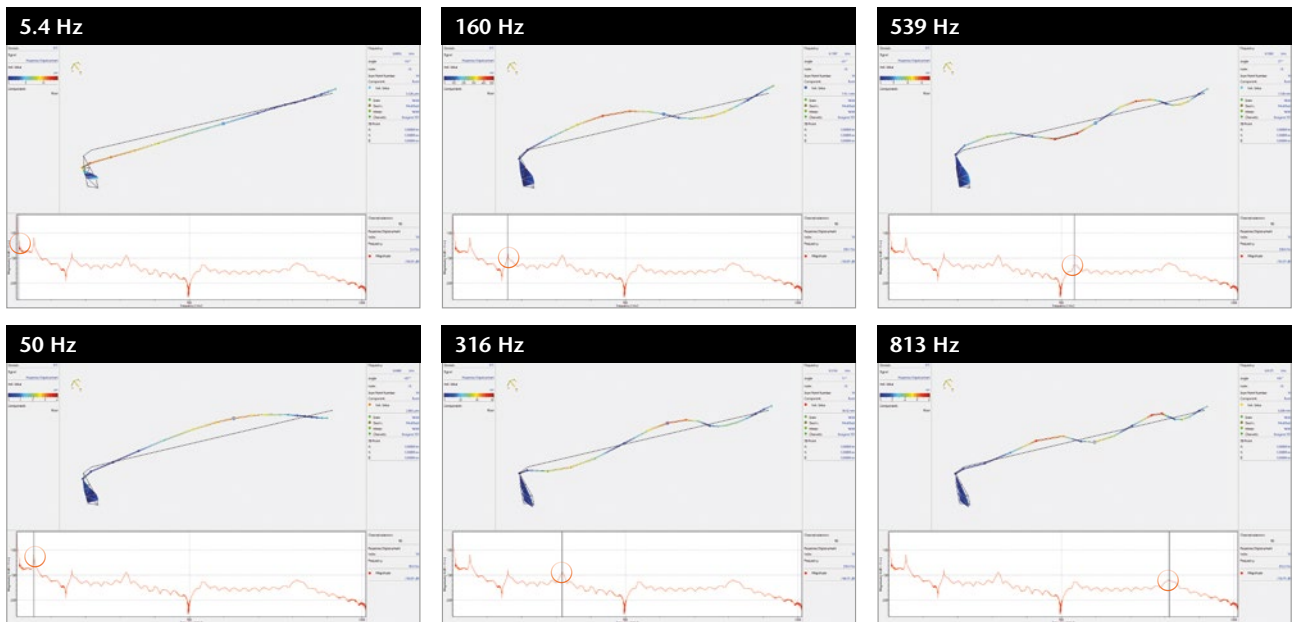


Figure 3: Frequency response and deflection shapes of the 9-iron during impact.

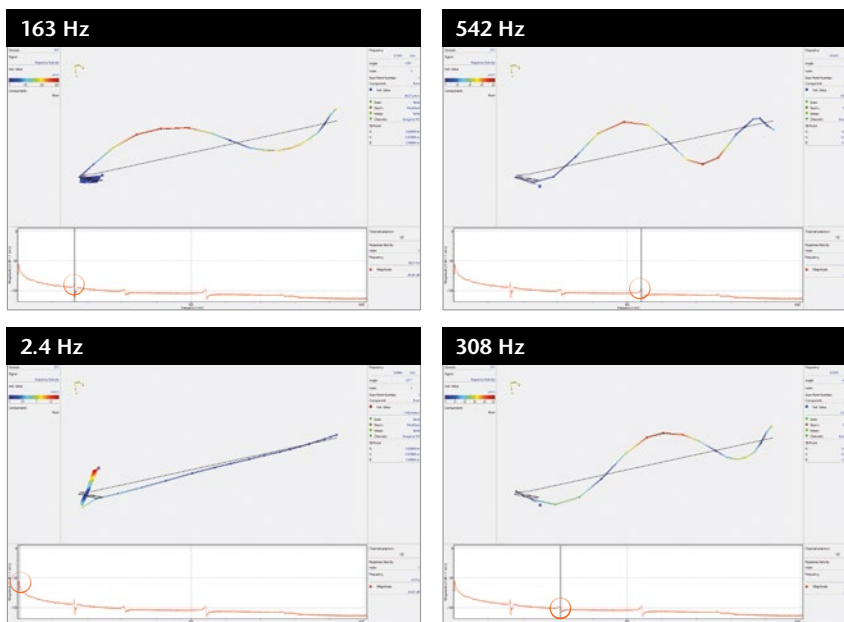


Figure 4: Frequency response and deflection shapes of the putter during impact.

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