

Deterministic Stroke

A timed stroke and a determined stroke fail differently. The distinction is the difference between a result that must be achieved in the strike and one that was settled before it.

Consider how a stroke squares the clubface. One way is to fire a muscular input at the right instant—a forearm rotation timed so the face arrives square at impact. The validated three-dimensional forward-dynamic model does exactly this: lacking the closed chain that would square the face by geometry, it squares the face through a precisely-timed forearm torque, and it reports the result “especially sensitive to changes in the timing of the forearm torque,” too early closing the face and too late opening it (Balzerson, Banerjee, and McPhee, p. 12). That sensitivity is not a defect of the model. It is what squaring-by-timing is: a narrow window the input must hit, every swing.

TIGHTER GOLF squares the face by constraint. [...] There is no window to hit, because the squaring was solved at setup rather than executed in the strike. As long as the assembly holds, it delivers the same square face whether the stroke is fast or slow, fresh or fatigued, calm or under pressure. The stroke is deterministic.

This is the practical weight of constraint over compensation. A stroke that depends on timing depends on hand-eye coordination and rhythm—faculties that vary within a round, degrade under fatigue, and decline with age. A deterministic stroke does not draw on them, because nothing in it waits to be timed. The forward-dynamic model omits the trailing arm that closes the chain, so it must hit a timing window within milliseconds, one a golfer would have to manage by feel. With the closed chain satisfied, there is no such window. A deleted constraint does not vanish. It reappears as something the golfer must do under load. A satisfied constraint asks nothing of the strike.

This is why the stroke’s assembly is verified at setup and not pursued in motion. The acceptance tests certify the assembly before the stroke begins; once the assembly holds, the square face follows by geometry. There is no moment of truth to time, no instant where hand and eye must coincide. The stroke does not have to be steered to a square face. It was built to arrive at one.

Source: Balzerson, Daniel, Joydeep Banerjee, and John McPhee. “A Three-Dimensional Forward Dynamic Model of the Golf Swing Optimized for Ball Carry Distance.” *Sports Engineering* 19, no. 4 (2016): 237–250. <https://doi.org/10.1007/s12283-016-0197-7>. Page reference (p. 12) is to the accepted manuscript, University of Waterloo institutional repository: <https://dspacesmainprd01.lib.uwaterloo.ca/server/api/core/bitstreams/8e0140f3-6680-4736-a83f-b0515d4e8003/content>.