



Soccer ball path optimization

By Adedeji B. Badiru

Soccer's World Cup will take place in South Africa this summer. Generally considered the most popular sport in the world, soccer will garner massive worldwide attention during the World Cup with all of the accompanying dramas, thrills and plays associated with the game. It turns out that the execution of soccer plays and shots has a lot of relationship with STEM (science, technology, engineering and math) and O.R. optimization. Although players don't explicitly solve optimization problems, superior players do, indeed, intuitively and subconsciously engage in soccer ball path optimization moves.

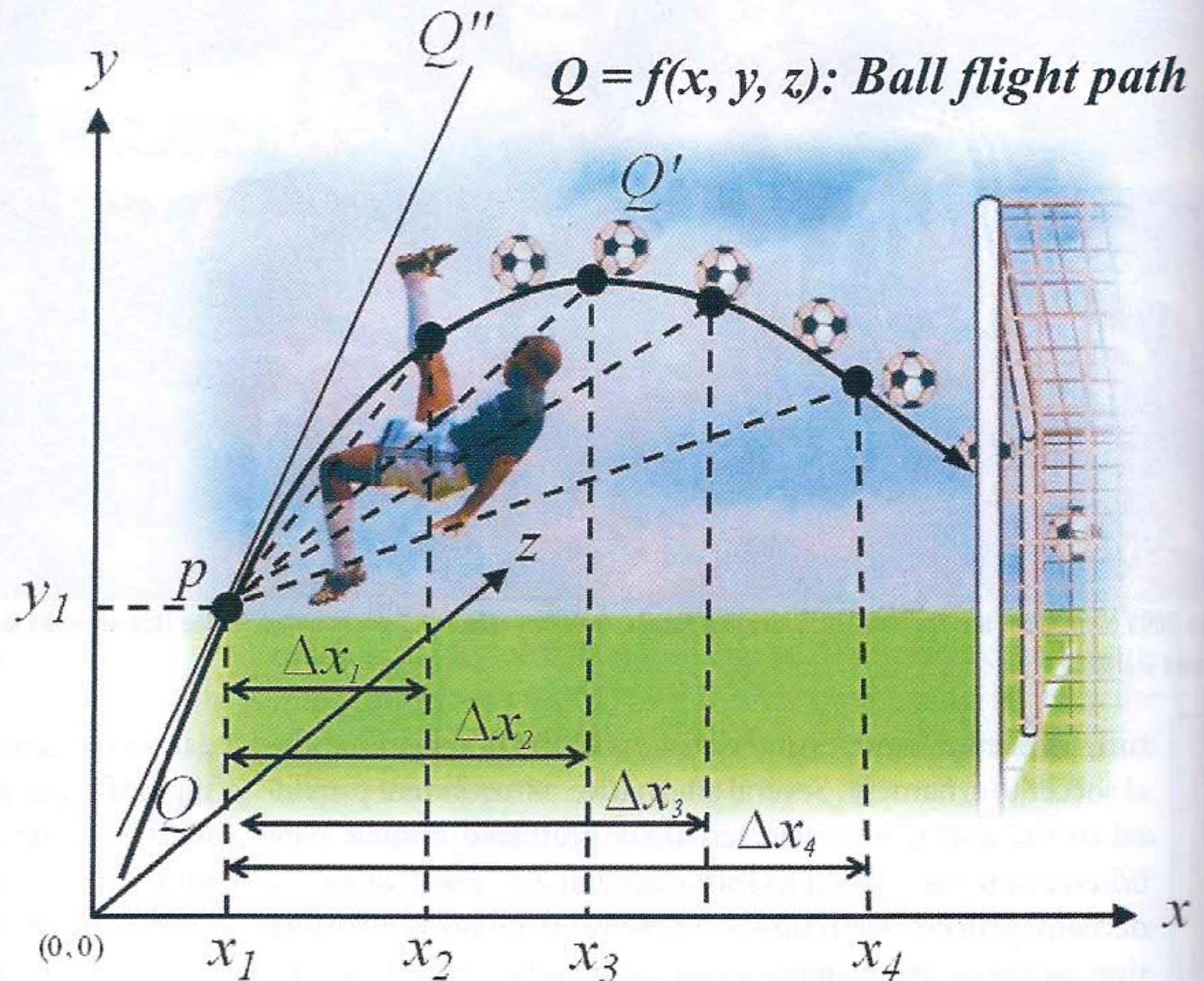
Many of us remember the "Bend It Like Beckham" fame of David Beckham, the professional soccer player who is reputed to be able to bend the soccer ball on desired curved paths. In one press interview, he was asked how he does it. His reply was that he just does it based on years of practice. Well, some people do solve optimization problems by developing on-paper models, while others solve their own optimization problems through hours and hours of experimentations. The learned solution then becomes a thing of beauty to behold but can hardly be explained.

The new book, "The Physics of Soccer: Using Math and Science to Better Your Game [1]," sheds some sports light (yes, sports light) on the importance of intuitive mathematical reasoning in executing plays in a sport that means so much globally.

In 2006, soccer became the peace-making nucleus of a civil war in the Ivory Coast, a West African nation, where the rebel-held North and the government-controlled South had been at odds for many years. With World Cup qualification, the national soccer team used every press platform to plead for peace in their native languages, the members having come from diverse localities and ethnic affiliations. The spirit of "the game" inspired hundreds of thousands of people to put down their weapons and focus on the soccer field, enlivened by the heightened activity that only soccer can produce: velocity, ball control, meticulous communication through movement, teamwork and the joy of victory. Today, South Africa is gearing up to host Soccer World Cup 2010 and we can only imagine the far-reaching implications. This type of event will be unprecedented for the continent of Africa. As of December, outside of Africa residents, the most tickets to the 2010 World Cup had been sold in the United States (approx. 85,000). O.R. can capitalize on this phenomenon through an increased awareness of the role that math and science can play in designing and executing soccer plays.

Ball Path Modeling

The game of soccer is about motion. Physics is about the laws of motion, and it can be applied in an O.R. context to model and optimize soccer ball path. Consider the soccer ball path depicted in Figure 1. Although we usually think of the ball moving in conceived x



and y directions, the ball actually has a z-component as well. This is best visualized when a player executes an over-the-head bicycle kick as shown in Figure 1. The z component is important because the player may not be positioned directly in front of the goal when the kick is executed. In order to get the ball into the goal, the player must quickly execute the move in such a way that the ball follows the desired path within the x-y-z axes. That is ball path optimization! Hopefully, O.R. enthusiasts who also happen to be soccer aficionados can have fun experimenting with this type of modeling either on paper or on a real pitch.

Conclusion

Soccer builds character. The game extends and builds positive attributes in players. From physical and mental alertness, teamwork, sportsmanship, selflessness and leadership to good work ethics, the game of soccer helps a player to develop as a total person. Increasing the awareness of math and science in soccer can help others view the game more positively from an intellectual standpoint rather than from just a brawny view.

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Reference

1. Badiru, Deji, 2010, "The Physics of Soccer: Using Math and Science to Better Your Game," www.iUniverse.com.